

# DSP Selection Guide

Digital Signal Processors • OMAP™ Processors • System Solutions • Development Tools

3Q 2005



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## TI Worldwide Technical Support

### Internet

**TI Semiconductor Product Information Center Home Page**  
[support.ti.com](http://support.ti.com)

**TI Semiconductor KnowledgeBase Home Page**  
[support.ti.com/sc/knowledgebase](http://support.ti.com/sc/knowledgebase)

### Product Information Centers

#### Americas

Phone +1(972) 644-5580 Fax +1(972) 927-6377  
 Internet/E-mail [support.ti.com/sc/pic/americas.htm](http://support.ti.com/sc/pic/americas.htm)

#### Europe, Middle East, and Africa

Phone  
 Belgium (English) +32 (0) 27 45 54 32 Netherlands (English) +31 (0) 546 87 95 45  
 Finland (English) +358 (0) 9 25173948 Russia +7 (0) 95 363 4824  
 France +33 (0) 1 30 70 11 64 Spain +34 902 35 40 28  
 Germany +49 (0) 8161 80 33 11 Sweden (English) +46 (0) 8587 555 22  
 Israel (English) 1800 949 0107 United Kingdom +44 (0) 1604 66 33 99  
 Italy 800 79 11 37  
 Fax +(49) (0) 8161 80 2045  
 Internet [support.ti.com/sc/pic/euro.htm](http://support.ti.com/sc/pic/euro.htm)

#### Japan

Fax  
 International +81-3-3344-5317 Domestic 0120-81-0036  
 Inquiry Web Site (Japanese) [www.tij.co.jp/pic](http://www.tij.co.jp/pic)  
 Inquiry Web Site (English) [www-k.ext.ti.com/sc/technical-support/pic/japan.htm](http://www-k.ext.ti.com/sc/technical-support/pic/japan.htm)  
 DSP User Forum [www.tij.co.jp/DSPForum](http://www.tij.co.jp/DSPForum)

#### Asia

Phone  
 International +886-2-23786800 Toll-Free Number  
 Domestic Toll-Free Number  
 Australia 1-800-999-084 New Zealand 0800-446-934  
 China 800-820-8682 Philippines 1-800-765-7404  
 Hong Kong 800-96-5941 Singapore 800-886-1028  
 Indonesia 001-803-8861-1006 Taiwan 0800-006800  
 Korea 080-551-2804 Thailand 001-800-886-0010  
 Malaysia 1-800-80-3973  
 Fax 886-2-2378-6808 E-mail [tiasia@ti.com](mailto:tiasia@ti.com)  
 Internet [support.ti.com/sc/pic/asia.htm](http://support.ti.com/sc/pic/asia.htm)  
[ti-china@ti.com](mailto:ti-china@ti.com)

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## Web-Based DSP Support Tool Available Now

Responding to demand from engineers recently becoming more familiar with DSP, TI launched an easy-to-use, web-based tool that helps customers progress their designs from inspiration to implementation. Designers choosing to use TI DSPs in their real-time applications receive easy-to-access introductory DSP content through TI's Getting Started with DSP website ([www.ti.com/gettingstarted](http://www.ti.com/gettingstarted)), which decreases the learning curve and accelerates products to market.

Due to a myriad of applications in multiple markets utilizing digital signal processing, the number of first-time DSP designers needing guidance on getting started is expanding. TI's new support tool reduces complexity and leaves engineers with a clear roadmap of actions and activities that will accelerate their development time.

This web-based tool answers the following primary questions:

- What is DSP?
- Which TI DSP should I use?
- How do I get going?
- What else can help me?

### Basic Steps to Starting Development

#### • Step One: Selecting a DSP Processor

If you are not sure which TI DSP platform will best suit your application, visit **Which TIDSP is Right for Me?** to assist you in your decision.

#### • Step Two: Evaluation of DSP Technology and Tools

The Evaluation stage includes learning how to use a DSP, evaluation of the DSP as a possible processor solution and evaluation of development tools. The following TI development tools are designed for the Evaluation stage:

- **Free Evaluation Tools** – A free 120-day trial period of Code Composer Studio™ IDE.
- **DSP Starter Kit (DSK)** – A DSP-based board with a special version of Code Composer Studio IDE restricted to use only with the DSK target board. The DSK is a low-cost, entry-level tool starting at U.S. \$295.

#### • Step Three: Initial Development

In the Initial Development stage, you have already decided which DSP to use, but beta boards have not been built. The tools to meet the needs of this stage include:

- **Code Composer Studio IDE** – Code Composer Studio (CCStudio) IDE includes all the software (including hardware drivers) needed for development through the production/support stage. CCStudio IDE pricing starts at U.S. \$495.
- **Evaluation Module (EVM) and Developer's Kits** – A wide variety of DSP boards and production-ready development kits are available from TI and TI's Third Party Network. Products include development boards or evaluation modules, and hardware/software bundles designed to accelerate the application design process from concept through production. Kit pricing starts at U.S. \$1,495.

#### • Step Four: Product Development

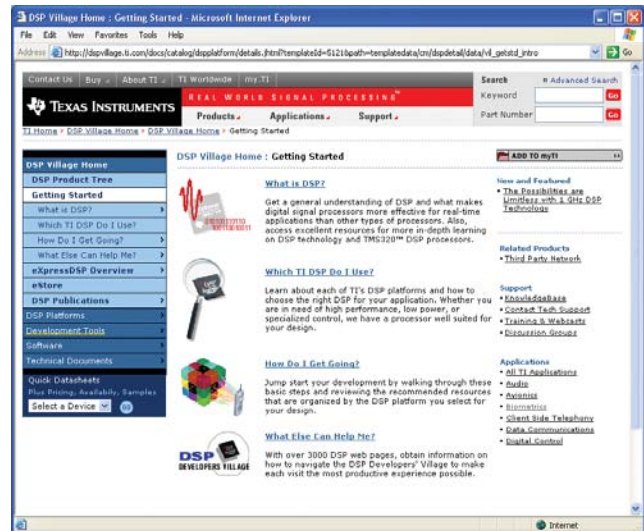
In the Product Development stage, there is a need for full development capabilities – including debugging of product hardware and software. Tools designed to meet those needs include:

##### Emulation Technology

- **Code Composer Studio IDE** – CCStudio IDE includes all the software (including hardware drivers) needed for development through the production/support stage. CCStudio IDE pricing starts at U.S. \$495.
- **Emulation** – The XDS510™ and XDS560™ emulators are used for JTAG emulation. In order to debug custom target boards, a 14-pin JTAG header needs to be included on the board and it connects to a PC via the JTAG emulation cable. XDS emulator pricing starts at U.S. \$1,500.

##### Third Party Network

As you progress in your development, you can speed your time-to-market by utilizing Texas Instruments Third Party Network. The Third Party Network offers the most extensive collection of Digital Signal Processing development support in the industry.



The easily navigated site describes digital signal processing and offers extensive training. In addition, the site discusses how signal processing tasks can be implemented on a DSP as well as when to use such a device.

Since personal electronic devices have power, performance and price demands that are perfectly suited to a certain type of DSP, the site also aids designers in determining which TI DSP platform is right for their applications. Providing the customers a clear understanding of each option, it connects to information such as white papers and technical briefs.

Aside from being a tutorial on TI DSPs, the site also offers precise information on how to begin designing, what problems to look for as well as how to solve those problems. With resources available both on and off the Web, customers can minimize their design time and employ the industry knowledge of TI's in-house experts.

The support continues even once the design process commences. Texas Instruments developed the industry's most comprehensive support network that can be accessed using the new on-line tool. Building on the premise that a supplier should facilitate the design process, the network encompasses training, technical information and access to experts. TI will be completely supportive throughout the entire DSP design process.

To assist you in getting started with DSP, TI offers the free "The Essential Guide to Getting Started with DSP" CD-ROM which includes a variety of resources to start your DSP design. To order your free CD, visit: [www.ti.com/getstartedwithdsp](http://www.ti.com/getstartedwithdsp). Or, to start utilizing the Getting Started with DSP web-based tool, visit [www.ti.com/gettingstarted](http://www.ti.com/gettingstarted)



## Audio

### Audio System Solutions

Get additional information at: [www.ti.com/audio](http://www.ti.com/audio)

#### Targeted Applications

- Musical instruments
  - Instrument amplifiers
  - Multi-track recorders
  - Synthesizers
  - Guitar effects
- Professional audio
  - Digital mixers
  - Signal processors
  - Broadcast encoders
  - DSP farms
- Home audio
  - AV receivers
  - DVD receivers
  - Home audio jukeboxes
  - Networked audio players
- Portable audio devices
  - HDD-based MP3 players
  - Flash/CD-based MP3 players
  - Wireless audio headphones
- Digital radio

#### Audio Systems Overview

Advances in digital audio technologies offer consumers the ability to enjoy their audio at anytime, anywhere and on any device. This new trend in audio is enabled by DSPs that offer this convenience without any sacrifice in quality. DSP technology is also at the forefront of another amazing trend in consumer audio products, the multichannel listening experience. Due to the rapid drop in price points, consumers are enjoying music, movies and television on high-quality, DSP-based 5.1 audio systems.

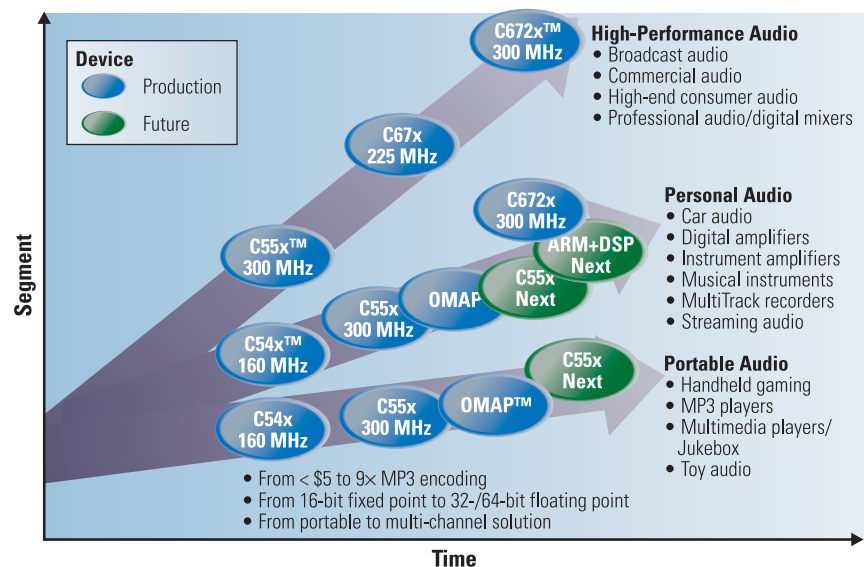
Just as the consumer audio market is benefiting from advances in audio technology, the professional and musical instrument markets are delivering new products that maintain the highest sonic quality at affordable price points. By leveraging DSP horsepower, these markets are giving musicians and sound engineers the ability to create the exact sounds they want.

In order to enable designers of digital audio products to leverage advanced

digital audio techniques, TI provides silicon, software, systems expertise and support focused solely on digital audio technologies. TI currently offers a host of products including DSPs, class-D amplifiers, A/Ds, D/As and SRCs that are designed from the ground up to deliver the most realistic audio experience possible at cost-effective price points. Since TI solutions are based on programmable platforms and flexible analog components, developers have maximum flexibility in designing products that meet the needs of the rapidly changing digital audio landscape.

#### TI Audio Systems Benefits

- Highest performance allows room for innovation with application-specific digital entertainment solutions
- Programmability and scalability provide open-audio platforms for better differentiation
- Compact form factor for cool product designs and great sound
- Easy-to-use, application-specific software and tools get you to market faster



Audio Solutions Roadmap



## Audio eXpressDSP™-Compliant Third-Party Algorithms

Texas Instruments, in conjunction with its industry-leading DSP Third Party Network, offers eXpressDSP-compliant

algorithms for audio designed to reduce system integration time and lower support and development costs. For a listing

of algorithms and the third parties that make these available, see pages 65–71 or visit [www.ti.com/algorithms](http://www.ti.com/algorithms)

AUDIO ALGORITHMS
3D Stereo
AAC Decoder
AAC Encoder
Acoustic Echo Canceller
Adaptive Noise Canceller
Chorus
Chorus Effect
Circle Surround II
Dolby® 5.1 Encode
Echo Effect
Equalizer
Flange Sound Effect
Flanger

AUDIO ALGORITHMS (CONTINUED)
Full-Duplex Echo Cancellation
Full-Spectrum Dynamic Compression
Function Generator
Mixer
Mono Eq 4 Band
MP3 Decoder
MP3 Encoder
MPEG-2 AAC Encoder
MPEG-2 L3 Decoder
MPEG-2/4 AAC Decoder
MPEG-2/4 AAC Encoder
MPEG-4 AAC LC Decoder
MPEG-4 AAC LC Encoder

AUDIO ALGORITHMS (CONTINUED)
Noise Reduction
Noise Reduction, Low Frequency
Pathfinder Noise Suppression
Phase-Corrected Equalization
Reverb
Reverb Effect
Sample Rate Conversion
Speech Compressor for Hearing Aids
Time-Scale Tailor
VIP – Voice Intelligibility
WMA Decoder

## Audio Application Notes

Application Note	Web Search Literature #
OMAP5910 Processor Audio System Design	SPRA970
Decoding Convolutional and Turbo Codes in 3G Wireless White Paper	SPRA878
MP3/AAC™ Player Implementation in RF3	SPRA779
Using the File Navigation API Function in an IACD System	SPRA834
Electronic Shock Protection (ESP) for CD Players That Use a C54x™ DSP	SPRA831
TMS320C6201/6701 EVM: TMS320C6000 McBSP to Multimedia Audio Codec	SPRA477
Meeting the Pro Audio Challenge White Paper	SPRAAA3
Using the TMS320C672x Bootloader	SPRAA69

Application Note	Web Search Literature #
TMS320C6000™ McBSP to Voice Band Audio Processor (VBAP) Interface	SPRA489
AIC27 Example for the TMS320C5510 DSP Prototype Board	SPRA813
Implementation of AC-3 Decoder on TMS320C62x DSPs	SPRA724
An Audio Example Using DSP/BIOS™ Kernel	SPRA598
Interfacing TLC320AD57 Sigma-Delta Stereo ADC (in Master Mode) with TMS320C5x DSP	SPRA090
TMS320C6713 to TMS320C672x Migration Guide	SPRAA78

Check the TI website for a complete listing of technical documentation including application notes.

## Audio Integrated Solution

**Professional Audio Development Kit (PADK)** – The PADK (part number TMDXPK6727) is a hardware/software solution based on the new TMS320C672x™ floating-point DSPs. The C672x™ DSPs are optimized for professional audio, musical instruments, broadcast audio and commercial audio applications.

The PADK integrates the TMS320C6727 DSP with Burr-Brown ADCs and DACs. This board also features a host of different I/O options and connectors. In addition to the hardware, the PADK includes real-world audio software example code to demonstrate C672x DSP performance and provide a good reference for developers to create customized applications. Further enhancing the utility board is a convenient expansion slot that can allow daughtercards to be used to evaluate other components not featured on the PADK.

The comprehensive PADK includes the hardware and software needed to quickly design differentiated pro-audio applications.

For more information, contact your authorized TI distributor or visit [www.ti.com/padk](http://www.ti.com/padk)



PADK includes hardware, software and documentation to get started immediately.



## Biometrics

### Biometrics System Solutions

Get additional information at: [www.ti.com/biometrics](http://www.ti.com/biometrics)

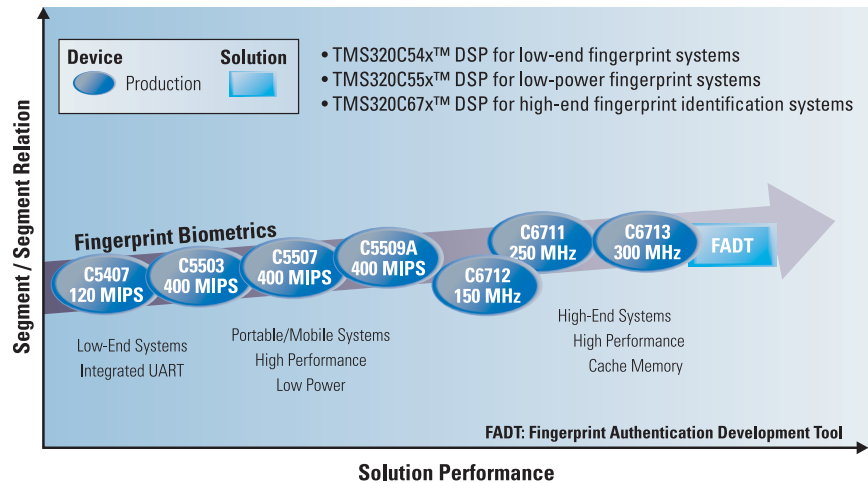
#### Targeted Applications

- Physical access/door locks
- Time and attendance
- Computer access
- Point-of-sale (POS) terminals
- Automotive and home security
- Safety deposit boxes/safes
- Cash access machines/ATMs
- Mobile phones and PDAs

#### Biometrics Systems Overview

The biometrics market is demanding intelligent security features in faster, smaller, lower-cost and convenient-to-use products. To provide the market with better security, more accuracy and speed, OEMs and security product manufacturers need to develop applications with the capability to handle intricate algorithms for processing image and video compression, image enhancement, normalization, feature extraction, matching and a host of others. A high-performing processor is

an absolute must to meet these demands, but that is not the only consideration. The growing security market needs the right mix of performance, low power consumption and system flexibility to develop the customized features for each product niche. TI offers a variety of DSPs that match these needs as well as software for many of the functions. TI's DSP performance and programmability allows you to move fast and secure your product's position in the market at the right price point.



#### Biometrics Solutions Roadmap



## Biometrics eXpressDSP™-Compliant Third-Party Algorithms

Texas Instruments, in conjunction with its industry-leading DSP Third Party Network, offers eXpressDSP-compliant

algorithms for biometrics designed to reduce system integration time and lower support and development costs. For a

listing of algorithms and the third parties that make these available, see pages 65–71 or visit [www.ti.com/algorithms](http://www.ti.com/algorithms)

### BIOMETRIC ALGORITHMS

Biometrics Image Processing  
Fingerprint 1 to 1  
Fingerprint Recognition Pre  
Fingerprint Recognition Engine

### ENCRYPTION ALGORITHMS

3-DES  
AES  
Assembly

### ENCRYPTION ALGORITHMS (CONT'D)

Audio Watermark Det. SDMI Screen  
DES  
DES CBC Mode  
Diffie-Hellman  
ELGAMAL  
HMAC  
HMAC-MD5  
HMAC-SHA-1  
IDEA Decryption

### ENCRYPTION ALGORITHMS (CONT'D)

IDEA Encryption  
Kasumi Encryption  
MD5  
MD5-V2.0  
MMH-MAC  
NTRU Mobile Security  
RSA  
RSA1024  
SHA-1

## Biometrics Application Notes

Application Note	Web Search Literature #
DSP for Smart Biometric Solutions – White Paper	SPRA894
Performance Analysis of Face Recognition Algorithms on TMS320C64x™ DSPs	SPRA874
Wavelet Transforms in the TMS320C55x™ DSP	SPRA800

Application Note	Web Search Literature #
A DSP Kernel for On-Line Dynamic Handwritten Signature Verification Using TMS320™ DSPs	SPRA304
Speaker Independent Speech Recognition on the TMS320C2x and TMS320C5x DSPs	SPRA100

Check the TI website for a complete listing of technical documentation including application notes.

## Biometrics Integrated Solutions

**Fingerprint Authentication Development Tool (FADT)** – The FADT provides developers an easy-to-use, cost-effective way to evaluate and develop fingerprint authentication systems and products based on TI DSPs. The FADT consists of a daughtercard with all the software to get you started, plus the industry's first multi-platform, DSP-based expansion board that can combine with several of TI's DSP Starter Kits (DSKs). To enhance the range of easy-to-use, affordable fingerprint development tools, TI currently offers four different FADT products. Each FADT supports the different fingerprint sensors, Fingerprint Cards FPC1010 and FPC1031 sensors, AuthenTec sensor, Atmel FingerChip™ sensor, and has associated software and drivers.

The FADT is an ideal development tool for both entry-level and experienced designers, and its flexibility allows designers to choose from a range of integrated solutions. Developers also have access to TI's robust suite of eXpressDSP™ Software and Development Tools. This flexible and complete development environment for fingerprint authentication enables developers to quickly and inexpensively evaluate and develop systems and products based on TI DSPs, resulting in highly accurate products.

For more information, contact your authorized TI distributor or visit [www.ti.com/fadt](http://www.ti.com/fadt)



Fingerprint Authentication Development Tools



## Digital Control

### Digital Control System Solutions

Get additional information at: [www.ti.com/dmc](http://www.ti.com/dmc)

#### Targeted Applications

- Industrial
  - Automation
  - Drives
  - Flow meters
  - TEC controllers
  - Water quality testing
  - Electricity metering
  - Light / Color sensors
  - Capacitive / Piezoresistive sensors
  - Power line modem
- Digital power conversion
  - Rectifiers
  - Inverters
  - Converters
  - Ballast control
- Automotive
  - Electronic power steering
  - Integrated starter alternators
  - Brushless fuel pumps
  - Brake line pressure control
  - Engine knock detect and noise reduction
  - Engine valve and spark control
  - Short distance radar
  - Wiper control
  - Fuel sensors
  - Torque / Inertial sensors
- Appliances / White goods
  - Compressor motors
  - Drive motors
  - Induction cooking
- Medical
  - Muscle stimulators
  - Blood analysis
  - Oxygen sensors
- Consumer
  - RFID detection / deactivation
  - Bar code readers
  - Touch screen controllers
  - Audio feedback control
  - Noise cancellation
  - Musical effects
- Motor types
  - Single, three or six-phase
  - Sensored or sensorless
  - AC induction
  - Brushless DC
  - Brushed DC
  - Permanent magnet synchronous
  - Switched reluctance

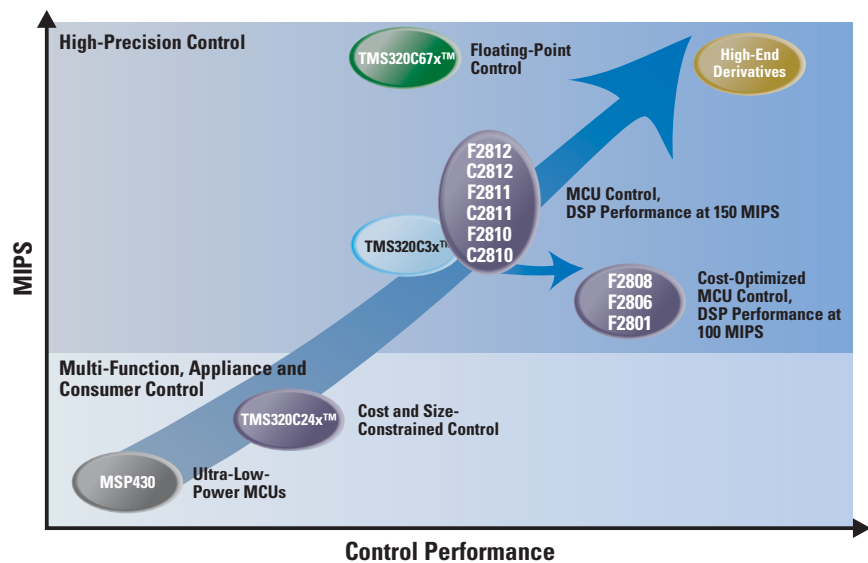
#### Digital Control Overview

Revolutionizing today's digital control applications, TI delivers DSP performance with MCU integration and ease of use that allow designers of industrial control, power conversion, automotive, appliance, medical and select consumer applications to quickly and easily implement advanced, cost-efficient control systems.

Our broad base of control-optimized silicon provides the industry's highest level of on-chip integration and powerful computational abilities that drive system cost down to unprecedented levels. The unique combination of processing power, interrupt handling capability, control-specific peripheral integration and high C-efficiency deliver substantial benefits to control systems. These benefits, such

as improved system efficiency and added performance for innovation, are delivered with fewer external components and reduced system costs in amazingly small packages great for space-constrained applications.

TI is focused on the digital control systems designers' needs and is continuing to develop solutions that serve the market. With more than 18 years of experience in processor-based control applications and a worldwide team dedicated to providing progressive embedded control solutions, we offer systems expertise, easy-to-use development tools, an extensive silicon range and unlimited support to get your product to market faster at lower systems costs.



Digital Control Solutions Roadmap



## Control Application Device Matrix

Applications		MSP430	TMS320C24x™ Controller	TMS320C28x™ Controller	TMS320C67x™ DSP
General Motor Control	White goods	•	•	•	
	Servo and stepper motors	•	•	•	
	3-phase motors		•	•	
	Industrial drives	•		•	•
	Robotics	•		•	•
Digital Power Supply	SMPS / UPS	•	•	•	
	Rectifiers		•	•	
	Inverters	•	•	•	
	Converters		•	•	
Optical Networking	TECS	•	•	•	
	EDFAS			•	
	MEMS OXC			•	•
Automotive	Electronic power steering (EPS)			•	
	Integrated starter alternator			•	
	Brushless motors			•	
Industrial	Instrumentation	•			
	Automation			•	
	Embedded control			•	

## Motor-Specific Software Solutions [www.ti.com/c2000appsw](http://www.ti.com/c2000appsw) and [www.ti.com/c2000sigproclib](http://www.ti.com/c2000sigproclib)

System	Motor Type	Sensored	Sensorless	Description	C24x™ Controller	C28x™ Controller
ACI1-1	1 ph AC Induction	•		Tacho I/P VHz / SinePWM / Closed Loop (CL) Speed PID	•	
ACI3-1	3 ph AC Induction	•		Tacho I/P VHz / SinePWM / CL Speed PID	•	•
ACI3-2	3 ph AC Induction		•	MRAS (Speed Estimator) VHz / SinePWM / CL Speed PID	•	•
ACI3-3	3 ph AC Induction	•		Tacho I/P FOC / SinePWM / CL Current PID for D, Q / CL Speed PID	•	•
ACI3-4	3 ph AC Induction		•	Direct Flux Estimator + Speed Estimator FOC / SinePWM / CL Current PID for D, Q / CL Speed PID	•	•
PMSM3-1	3 ph Permanent Magnet Synch	•		QEP FOC / SinePWM / CL Current PID for D, Q / CL Speed PID	•	•
PMSM3-2	3 ph Permanent Magnet Synch		•	SMO (Sliding Mode Observer) Position Estimator FOC / SinePWM / CL Current PID for D, Q / CL Speed PID	•	•
PMSM3-3	3 ph Permanent Magnet Synch	•		Resolver / FOC / CL Current PID for D, Q / CL Speed PID		•
PMSM3-4	3 ph Permanent Magnet Synch	•		QEP / FOC / Position Control		•
BLDC3-1	3 ph Trapezoidal Brushless DC	•		3 Hall Effect I/P Trapezoidal / CL Loop Current PID / CL Speed PID	•	•
BLDC3-2	3 ph Trapezoidal Brushless DC		•	BEMF / Zero Crossing Detection Trapezoidal / CL Loop Current PID / CL Speed PID	•	•
DCMOTOR	Brushed DC	•		Speed & Position / QEP without Index		•
Digital Motor Control Library	All Motor Types	•	•	Component Modules for Motor-Specific Applications	•	•

Motor-specific software downloads available today, free of charge, that allow designers to develop solutions for both sensed and sensorless control systems.



## Digital Control

### Digital Control eXpressDSP™-Compliant Third-Party Algorithms

Texas Instruments, in conjunction with its industry-leading DSP Third Party Network, offers eXpressDSP-compliant

algorithms for digital control designed to reduce system integration time and lower support and development costs. For a

listing of algorithms and the third parties that make these available, see pages 65–71 or visit [www.ti.com/algorithms](http://www.ti.com/algorithms)

#### DIGITAL CONTROL ALGORITHMS

Position Control  
RMS Signal Measurement  
Speed Control

#### DIGITAL CONTROL ALGORITHMS (CONT'D)

Torque Control for BLDC  
Torque Control for IMVC  
Torque Control for PMSM

#### DIGITAL CONTROL ALGORITHMS (CONT'D)

Vector PWM for Neutral Point Clamped 3-Level Inverters

### Get Started Today

Description	Part #	U.S.*
<b>Starter Kits</b>		
LF2407A eZdsp™ Starter Kit°	TMDSEZD2407 (U.S. part number) TMDSEZD2407-0E (European part number)	345
LF2401A eZdsp Starter Kit°	TMDSEZD2401 (U.S. part number) TMDSEZD2401-0E (European part number)	595
F2812 eZdsp Starter Kit°	TMDSEZD2812 (U.S. part number) TMDSEZD2812-0E (European part number)	395
F2812 eZdsp Starter Kit° (Socketed) Includes parallel port cable, User's Guide, Code Composer Studio™ (CCStudio) IDE for eZdsp, power supply	TMDSEZS2812 (U.S. part number) TMDSEZS2812-0E (European part number)	495
F2808 eZdsp Starter Kit° (Socketed) Includes USB cable, User's Guide, CCStudio IDE for eZdsp, power supply	TMDXEZS2808 (U.S. part number) TMDXEZS2808-0E (European part number)	495
TMS320C6713 DSP Starter Kit (DSK)	TMDSDSK6713 (U.S. part number) TMDSDSK6713-0E (European part number)	395
MSP430 Flash Emulation Tool Complete Integrated Development Environment including target board and parallel port interface	MSP-FET430Pxxx	99
MSP430 Flash Emulation Tool Complete Integrated Development Environment including target board and USB interface	MSP-FET430Uxx	149
<b>Evaluation Modules</b>		
LF2407A Evaluation Module (EVM), CCStudio IDE, XDS510PP-Plus Emulator§	TMDS3P701016A (U.S. part number) TMDS3P701016AE (European part number)	1,995
F2812 Development Bundle§ Includes eZdsp (socketed), CCStudio IDE, XDS510PP-Plus	TMDSEVP2812 (U.S. part number) TMDSEVP2812-0E (European part number)	1,995
F2812 Development Bundle§ Includes eZdsp (socketed), CCStudio IDE, XDS510™ USB Emulator	TMDSEVU2812 (U.S. part number) TMDSEVU2812-0E (European part number)	2,295
<b>JTAG Emulators</b>		
XDS510PP-Plus Parallel Port Pod with JTAG Cable for Windows	TMDSEMUPP (U.S. part number) TMDSEMUPP-0E (European part number)	1,500
XDS510 USB-Based Emulator for Windows	TMDSEMUUSB	1,995
XDS560™ Blackhawk USB High-Performance JTAG Emulator	TMDSEMU560U TMDSEMU560U-0E (European part number)	2,995
XDS560 PCI-Based High-Performance JTAG Emulator	TMDSEMU560	3,995

\* Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing.

Alternative Development Tools are available from third parties such as EWA Blackhawk DSP ([www.blackhawk-dsp.com](http://www.blackhawk-dsp.com)), Spectrum Digital ([www.spectrumdigital.com](http://www.spectrumdigital.com)), Technosoft ([www.technosoft.ch](http://www.technosoft.ch)) and Softronix ([www.softronix.com](http://www.softronix.com)).

§ Includes Code Composer Studio integrated development environment (IDE), code generation tools with C compiler/assembler/linker, target board and device drivers.

° Includes board-specific Code Composer™ IDE, code-generation tools, on-board JTAG emulation, target board and target-specific device driver.



## Telecom System Solutions

Get additional information at: [www.ti.com/telecom](http://www.ti.com/telecom)

### Targeted Applications

- Wired telephony
  - Client-side telephony – for home networking (voice/data access points)
  - Remote data collection
  - Industrial monitoring systems
  - Full-duplex speakerphones
  - SMS/MMS phones
  - Intelligent phones
- Wireless terminal (excluding handsets)
  - Broadband wireless access boxes
  - Military and police wireless communication device
  - Digital pagers
  - Amateur radios
- Telecom accessories
  - Hands-free kit
  - Bluetooth® headset
- Infrastructure telecom
  - Enterprise
  - Gateway
  - SoHo

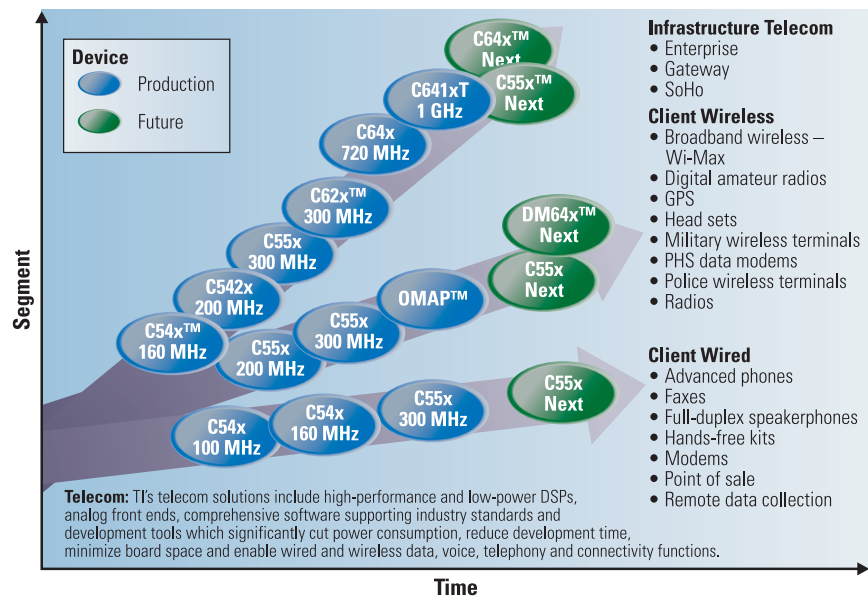
### Telecom Systems Overview

Telecom applications require the processing power to handle a wide variety of data, voice, telephony and connectivity functions. Using TI programmable DSPs, you can easily expand product capabilities and feature sets to match the demands of your design. In addition, you can customize, adapt and scale the DSP-based design to suit your particular requirements and focus on end-product differentiation.

TI offers complete DSP-based solutions for remote data collection, Internet connectivity, telephony co-processing and voiceband processing client-side telephony applications. These solutions provide

hardware including power-efficient/small form factor DSPs as well as analog front ends. In addition, comprehensive software is provided supporting industry standards as well as flexible software building blocks that accelerate the design process from concept through production.

These complete solutions significantly cut power consumption, reduce development time, minimize board space and enable multi-function applications, making a new class of Internet access devices possible. When you combine the processing power, high integration and flexibility with their low-price points and ease-of-use, TI DSPs are a perfect fit for telecom applications.



Telecom Solutions Roadmap



## Telecom

### Telecom eXpressDSP™-Compliant Third-Party Algorithms

Texas Instruments, in conjunction with its industry-leading DSP Third Party Network, offers eXpressDSP-compliant

algorithms for telecom designed to reduce system integration time and lower support and development costs. For a

listing of algorithms and the third parties that make these available, see pages 65–71 or visit [www.ti.com/algorithms](http://www.ti.com/algorithms)

#### FAX ALGORITHMS

T.38 Fax Relay over IP  
V.17 Modem  
V.21 Modem  
V.27 Modem  
V.27ter Modem  
V.29 Modem  
V.34 Modem

#### PROTOCOL STACKS ALGORITHMS

HDLC Generator Level 2  
HDLC Receiver  
HDLC Receiver Level 2  
HDLC Transmitter  
TCP/IP Protocol Stack

#### SPEECH ALGORITHMS

Acoustic Echo Cancellation  
Adaptive Speech Filter  
Broadband Noise Cancellation  
Caller ID Text-to-Speech  
Noise Reduction  
Sound Stretcher  
Speech Enhancement  
Text-to-Speech Synthesizer  
Speech Recognition  
Voice Activity Detector  
Voice Command Recognition

#### TELEPHONY ALGORITHMS

2100-Hz Tone Detector  
Acoustic Echo Canceller  
Auto Gain Control/Voice Activity Detector  
Call Progress Analysis  
Call Progress Decoder  
Call Progress Generator  
Call Progress Monitor  
Call Progress Tone Detector  
Caller ID Detector  
Caller ID Generator  
Caller ID, Type 1 and 2  
Comfort Noise Generator  
CPE Alert Signal  
CPT Detector

#### TELEPHONY ALGORITHMS (CONT'D)

CPT Generator  
DTMF Detector/Suppressor  
DTMF Encoder/Decoder  
Echo Cancellation, Multi-Echo Canceller  
Fax and Modem Tone Detect  
Frequency Shift Key Receive  
Frequency Shift Key Send  
G.165 Line Echo Cancellation  
G.167  
G.168 (Long Tail)  
G.168 (Short Tail)  
G.168-2000  
G.726 ADPCM Speech Codec  
MF (10 ms)  
MF R1 Detector  
MF R2 Forward Detector  
MF R2 Reverse Detector  
MF Line/Register Signaling  
Multifrequency Tone Detect  
Music On Hold  
Noise Floor Estimation  
Tone Detector  
Tone Disabler for LEC  
Universal Tone Detection  
Universal Multifrequency Tone Generator  
Variable Rate Convl. CODEC w/ Soft Decision  
VITERBI Decoding

#### VB MODEM ALGORITHMS

AGC  
BELL 103 Modem  
BELL 202 Modem  
Binary Phase Shift Key Modem  
G3MDP  
V.21  
V.22  
V.22 bis  
V.23  
V.32  
V.32 bis  
V.34

#### VB MODEM ALGORITHMS (CONT'D)

V.34+  
V.90  
V.92  
V.150  
V.42  
V.42 bis

#### VOCODERS ALGORITHMS

1200-BPS Codec  
2400-BPS Codec  
4800-BPS Codec  
6000-BPS Codec  
End Point Detector  
Enhanced G.711  
ESAC4 Codec  
ESAC7 Codec  
G.711 Codec  
G.711 PLC  
G.722 Codec  
G.722.1 Codec  
G.722.2 Codec  
G.723.1 Codec  
G.723A Codec  
G.726 ADPCM Codec  
G.726 U-Law ADPCM Codec  
G.728 Codec  
G.729 Codec  
G.729A Codec  
G.729AB Codec  
G.729B Codec  
G.729E Codec  
IPCM Wideband

#### WIRELESS ALGORITHMS

16-Bit CRC-CCITT Standard  
2.28-kbps/Hz PTM Decoder  
32-Bit CRC-CCITT Standard  
GSM-AMR Transcoder  
GSM AMR Codec  
GSM Enhanced Full-Rate Codec  
GSM Full-Rate Codec

### Telecom DSP Signal Processing Libraries

Signal Processing Libraries	Web Search Literature #
TMS320C5000™ DSP Foundation Software	<a href="http://www.dspvillage.ti.com/c5000dsplib">www.dspvillage.ti.com/c5000dsplib</a>
TMS320C54x™ DSP Software Library	<a href="http://www.ti.com/c54xdsplib">www.ti.com/c54xdsplib</a>

Signal Processing Libraries	Web Search Literature #
TMS320C55x™ DSP Software Library	<a href="http://www.ti.com/c55xdsplib">www.ti.com/c55xdsplib</a>



## Telecom Application Notes

Application Note	Web Search Literature #
TMS320C54CST Client Side Telephony DSP	SPRA187
Client Side Telephony (CST) Chipset Mode	SPRA859
TMS320C54CST Bootloader Technical Reference	SPRA853

Check the TI website for a complete listing of technical documentation including application notes.

## Telecom Integrated Solutions

The TMS320C5000™ DSP-based Telephony Developer's Kits include ready-to-go software and hardware that reduce your development time and allow you to focus on end-product differentiation.

**Client-Side Telephony Solution** – Perfect for customers developing remote data collection applications and advanced phone applications such as intelligent phone, SMS/MMS-enabled phone, secure phone, IP phone, USB phone and real/duplex speakerphone. This powerful tool uses the TMS320C54CST version 2.0 with 14 on-board algorithms and up to 40 kW of customizable RAM. The C54CST DSP is the industry's first complete one-chip solution – giving designers a comprehensive way of getting innovative industrial products to market quickly. For additional information, visit [www.ti.com/cst](http://www.ti.com/cst)

**Hands-Free Kit (HFK) Development Platform** – TI's HFK Development Platform is a complete DSP-based solution that brings unprecedented affordable, high-quality audio to consumer products. Providing real-time voice and audio enhancing algorithms as well as Bluetooth® connectivity, the HFK development platform enables developers to get higher quality audio products to market faster while reducing cost.



Hands-Free Kit Development Platform

Application Note	Web Search Literature #
Client Side Telephony (CST) Chip Flex Mode Flex Examples Description	SPRA862



Client-Side Telephony Developer's Kit

**SPIRIT CORP**  
DSP Software Source

Telephony algorithms provided by SPIRIT-DSP

With the Bluetooth daughter card, the HFK enables mobile device manufacturers to quickly and easily add Bluetooth functionality to their hands-free kit designs.

This DSP-enabled solution allows immediate development and differentiation of an end product by providing a baseline hardware and software design. The HFK development platform connects to TI's software development environment, Code Composer Studio™ Development Tools, through a JTAG connection.

This development environment combined with documentation provides fast integration of TI DSP third-party software and faster time-to-market.

The HFK development platform is ideally suited for high-quality, after-market hands-free kits where cost and performance are critical. Since the hands-free application has been fully integrated, developers can immediately focus on product differentiation. With 50-percent headroom on the TMS320C5407 DSP, developers can add a wide range of differentiating features, such as an LCD display or advanced speech recognition, to the baseline design as well as quickly integrate other functionality and algorithms available through TI's extensive network of more than 700 third party developers.

For more information, contact your authorized TI distributor or visit [www.ti.com/hfk](http://www.ti.com/hfk)



## Video and Imaging

### Video and Imaging System Solutions

Get additional information at: [www.ti.com/videoandimaging](http://www.ti.com/videoandimaging)

#### Targeted Applications

- Broadcast systems
- Cable head-end video equipments (routers)
- Digital camcorders
- Digital still cameras
- Digital TV and server head-ends
- Digital video recorders
- IP-based video-conferencing end-points
- IP-based videophones
- Hard-copy appliances
- Media encoder/decoder appliances
- Personal video recorders
- Professional-grade video broadcast equipment
- Security recording systems
- Set-top boxes
- Streaming video appliances
- Video-conferencing, multi-point conference units (MCUs)/gateways
- Video jukeboxes
- Video security systems
  - Video security camera (D1, CIF resolution and low cost)
  - Digital video security recorder (DVR)
- Video surveillance cameras
- Webpads
- Wireless cameras
- Automotive video sensing
- Machine vision and cognitive medical imaging

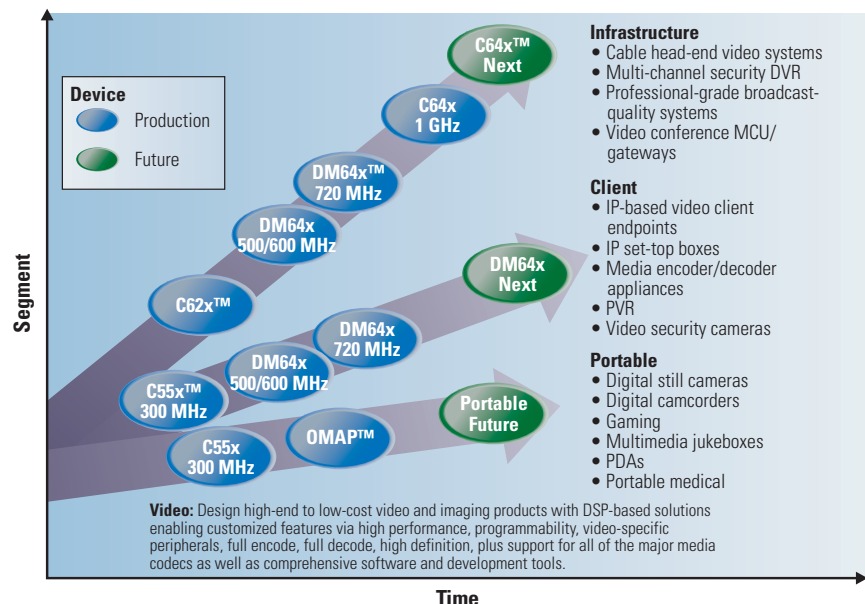
#### Video and Imaging Systems Overview

As the video and imaging markets continue to evolve with new functionality requirements and multiple emerging video standards (i.e., MPEG-4, H.264, Windows Media®, Real Video, etc.), developers need to adapt designs with the right balance of processing performance, power consumption and system flexibility. Portable and plugged applications need different levels of support for real-time video processing such as video coding, transcoding, transrating, as well as video and imaging instruction sets plus the right power consumption to meet market demands. TI DSPs provide the processing performance and programmability other processors are unable to provide. For example, the TMS320C64x™ DSP generation can perform simultaneous real-time (30 frames/second) MPEG-4 encoding and decoding at D1 resolution with high quality.

Performance and programmability allow developers to future-proof designs now to make the challenges of the future

simply opportunities to beat competition to market.

TI offers a number of products including hardware, software and integrated system solutions that are perfect for a variety of portable and plugged video and imaging applications. Numerous application development kits are available to get these designs off the ground quickly. These kits provide hardware and software at a variety of integration levels and price points to handle real-time performance, channel density, simultaneous processing of video, audio/voice and data streams across both wired and wireless networks. These kits help the developer create designs that provide the integration of various types of digital media streams and real-time delivery, avoiding network and system-level bottlenecks. In addition, the kits provide the flexibility to upgrade evolving digital media standards in software during system deployment and reduce the latency or lag times in delivering media content across different endpoints.



Video and Imaging Solutions Roadmap



## Video and Imaging Application Device Matrix

Applications		TMS320C55x™ DSP	OMAP™	TMS320C62x™ DSP	TMS320C64x™ DSP	TMS320DM64x™ DSP
Portable	Network camera	•				
	Digital still camera	•	•			
	Digital camcorder	•	•			
	Portable data terminals (PDT)	•	•			
Client	IP video phone					•
	Network IP camera			•		•
	Visual inspection			•	•	•
	Personal video recorder (PVR)					•
	Smart security camera					•
	Media encoder/decoder					•
	IP set-top box					•
Video Infrastructure	Video conferencing gateways				•	•
	Professional broadcast systems				•	
	Statistical multiplexer				•	
	Cable head-end video system				•	
	Multi-channel digital video recorder (DVR)				•	•
	Wireless video gateway				•	•

### High-Performance Media Solutions

High-performance digital media technologies cover a wide range of streaming media and emerging media-based technologies including integration of video, voice and data content into many new and different applications, reshaping the way digital media content is delivered.

Some of the challenges faced by digital media include real-time performance, greater channel density and the software programming flexibility for simultaneous processing of video, voice and data streams across both wired and wireless networks. Typical digital media processing functions include encoding and decoding media streams, transcoding (converting from one format to another), and transrating streams (scaling from a

higher to a lower bit rate) to accommodate various system-level dependencies. Other processing functions include compression, decompression, encryption, packetization and transport of media streams.

TI's TMS320DM642 digital media processor and the TMS320C64x™ generation of DSPs play a major role in enabling these technologies in video and imaging solutions. Based on the proven C64x™ DSP core technology, the DM642 and the C64x DSP are the highest-performance multimedia engines that are easy to upgrade with the latest software codecs.

For more information, please visit:

[www.ti.com/dm642intro](http://www.ti.com/dm642intro)

### Key Benefits

- Choose the option that fits your needs – broad range of high-performance/low-cost options with the TMS320DM640, DM641, DM642 and DM643 digital media processors
- Rapidly develop products with the latest algorithms due to code compatibility and full software programmability
- Utilize any video standard – the TMS320DM64x™ generation supports the latest industry standard algorithms including MPEG-4 AVC (H.264) encode and decode
- Get started today with TMS320DM64x DSP samples and the Digital Media Development Kit (DMDK)



## Video and Imaging

### Video and Imaging eXpressDSP™-Compliant Third-Party Algorithms

Texas Instruments, in conjunction with its industry-leading DSP Third Party Network, offers eXpressDSP-compliant algorithms for video and imaging

designed to reduce system integration time and lower support and development costs. For a listing of algorithms and the third parties that make these available,

see pages 65–71 or visit [www.ti.com/algorithms](http://www.ti.com/algorithms)

#### VIDEO & IMAGING ALGORITHMS

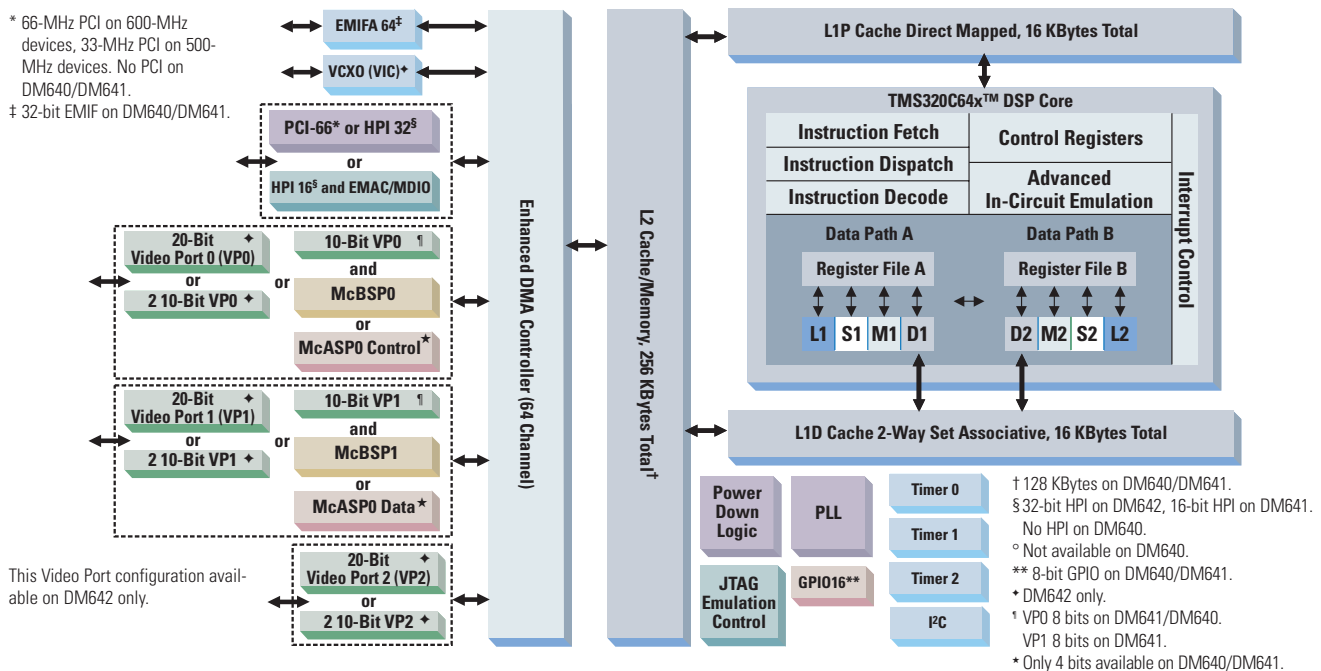
ACTL2 (800-kbps Broadband Codec)  
DVB-T Time Synchronization  
H.261 Decoder  
H.261 Encoder  
H.263 Decoder  
H.263 Decoder Ver 1.0  
H.263 Decoder Ver 2.0  
H.263 Encoder  
H.263 Encoder Ver 1.0  
H.263 Encoder Ver 2.0  
H.263 TDM to/from H.263 TCP/IP  
H.264  
H.323

#### VIDEO & IMAGING ALGORITHMS (CONT'D)

JPEG Codec  
JPEG Decoder  
JPEG Encoder  
MJPEG Codec  
MJPEG Decoder  
MJPEG Encoder  
MPEG-1 Decoder  
MPEG-1 Encoder  
MPEG-2 Decoder  
MPEG-4 Adv. Simple Profile Decoder  
MPEG-4 Adv. Simple Profile Encoder  
MPEG-4 ASP Level 4 Encoder  
MPEG-4 Core Profile Encoder

#### VIDEO & IMAGING ALGORITHMS (CONT'D)

MPEG-4 Decoder  
MPEG-4 Encoder  
MPEG-4 Simple Profile  
MPEG-4 Simple Profile Decoder  
MPEG-4 Simple Profile Encoder  
MPEG-4 Simple Profile Video Decoder  
MPEG-4 Simple Profile Video Encoder  
MPEG-4 VSP Decoder  
OFDM Demodulator  
RMS Compression  
Speedwave Decoder  
Speedwave Encoder  
VP4 Decoder



#### TMS320DM640 / DM641 / DM642 DSP Block Diagram

The TMS320DM64x digital media processors give designers the industry's most powerful, flexible and easy-to-use solutions for high-performance digital media applications.

#### Targeted Applications for TMS320DM64x™ Generation

- IP Phone
- Network IP Camera
- Visual Inspection
- Personal Video Recorder (PVR)
- Smart Security Camera
- Media Encoder/Decoder
- IP Set-Top Box
- Video Conferencing Gateways
- Multi-Channel Digital Video Recorder (DVR)
- Wireless Video Gateway



Get additional information at: [www.ti.com/videoandimaging](http://www.ti.com/videoandimaging)

## TMS320DM64x™ DSP Generation – Video Application-Specific Fixed-Point DSPs

Part Number	Internal RAM (Bytes) L1 Program Cache/ L1 Data Cache/ L2 Unified RAM/Cache	Video Ports	McBSP	Enhanced DMA (Channels)	COM°	Timers	MHz	MIPS	Power (W)		Voltage (V)		Packaging	1 KU (U.S.)†
									CPU and L1‡	Total*	Core	I/O		
<b>Video Application Specific</b>														
TMS320DM640GDK400	16K/16K/128K	1 8-bit	2	64	EMAC	3	400	3200	0.264	1.15	1.2	3.3	548 BGA, 23 mm	22.54
TMS320DM640GNZ400	16K/16K/128K	1 8-bit	2	64	EMAC	3	400	3200	0.264	1.15	1.2	3.3	548 BGA, 27 mm	22.54
TMS320DM641GDK500	16K/16K/128K	2 8-bit	2	64	HPI 16/EMAC	3	500	4000	0.33	1.3	1.2	3.3	548 BGA, 23 mm	30.77
TMS320DM641GNZ500	16K/16K/128K	2 8-bit	2	64	HPI 16/EMAC	3	500	4000	0.33	1.3	1.2	3.3	548 BGA, 27 mm	30.77
TMS320DM641GDK600	16K/16K/128K	2 8-bit	2	64	HPI 16/EMAC	3	600	4800	0.558	1.9	1.4	3.3	548 BGA, 23 mm	33.84
TMS320DM641GNZ600	16K/16K/128K	2 8-bit	2	64	HPI 16/EMAC	3	600	4800	0.558	1.9	1.4	3.3	548 BGA, 27 mm	33.84
TMS320DM643GDK500 <sup>§</sup>	16K/16K/256K	2 20-bit	1	64	HPI 32/EMAC†	3	500	4000	0.33	1.3	1.2	3.3	548 BGA, 23 mm	36.10
TMS320DM643GNZ500 <sup>§</sup>	16K/16K/256K	2 20-bit	1	64	HPI 32/EMAC†	3	500	4000	0.33	1.3	1.2	3.3	548 BGA, 27 mm	36.10
TMS320DM643GDK600 <sup>§</sup>	16K/16K/256K	2 20-bit	1	64	HPI 32/EMAC†	3	600	4800	0.558	1.9	1.4	3.3	548 BGA, 23 mm	39.49
TMS320DM643GNZ600 <sup>§</sup>	16K/16K/256K	2 20-bit	1	64	HPI 32/EMAC†	3	600	4800	0.558	1.9	1.4	3.3	548 BGA, 27 mm	39.49
TMS320DM642GDK500	16K/16K/256K	3 20-bit	2 <sup>§</sup>	64	PCI/HPI 32/EMAC†	3	500	4000	0.33	1.3	1.2	3.3	548 BGA, 23 mm	42.89
TMS320DM642GNZ500	16K/16K/256K	3 20-bit	2 <sup>§</sup>	64	PCI/HPI 32/EMAC†	3	500	4000	0.33	1.3	1.2	3.3	548 BGA, 27 mm	42.89
TMS320DM642GDK600	16K/16K/256K	3 20-bit	2 <sup>§</sup>	64	PCI/HPI 32/EMAC†	3	600	4800	0.558	1.9	1.4	3.3	548 BGA, 23 mm	48.25
TMS320DM642GNZ600	16K/16K/256K	3 20-bit	2 <sup>§</sup>	64	PCI/HPI 32/EMAC†	3	600	4800	0.558	1.9	1.4	3.3	548 BGA, 27 mm	48.25
TMS320DM642GDK720	16K/16K/256K	3 20-bit	2 <sup>§</sup>	64	PCI/HPI 32/EMAC†	3	720	5760	0.67	2.15	1.4	3.3	548 BGA, 23 mm	67.79
TMS320DM642GNZ720	16K/16K/256K	3 20-bit	2 <sup>§</sup>	64	PCI/HPI 32/EMAC†	3	720	5760	0.67	2.15	1.4	3.3	548 BGA, 27 mm	67.79

<sup>§</sup> The DM642 can be configured to have up to three serial ports in various video/McASP/McBSP combinations. Note: Enhanced plastic and Military DSP versions are available for selected DSPs.

<sup>†</sup> The DM640 has an Ethernet MAC. The DM641 can be configured to have either a 16-bit HPI or Ethernet MAC. The DM643 can be configured to have either a 32-bit HPI or a 16-bit HPI and Ethernet MAC. The DM642 can be configured to have either a 32-bit PCI or 32-bit HPI or a 16-bit HPI and Ethernet MAC.

<sup>‡</sup> Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order.

<sup>\*</sup> Assumes 60% CPU utilization, 50% EMIF utilization (133 MHz for 1.4 V, 100 MHz for 1.2 V), 50% writes, 64-bits, 50% bit switching, 2 2-MHz McBSP at 100% utilization, and 2 50-MHz timers at 100% utilization. See SPRA962.

<sup>‡</sup> Assumes 60% CPU utilization.

<sup>°</sup> HPI is selectable, 32-bit or 16-bit.

<sup>¶</sup> Production scheduled for 3Q05.

<sup>‡</sup> New devices are listed in red.

## Video and Imaging DSP Signal Processing Libraries

Signal Processing Libraries	Web Search Literature #
TMS320C55x™ DSP Imaging Software Library	<a href="http://www.ti.com/c55ximagingdspilib">www.ti.com/c55ximagingdspilib</a>
TMS320C62x™ DSP Image Library	<a href="http://www.ti.com/c62xdspilib">www.ti.com/c62xdspilib</a>

Signal Processing Libraries	Web Search Literature #
TMS320C64x™ DSP Image Library	<a href="http://www.ti.com/c64ximagelib">www.ti.com/c64ximagelib</a>

## Video and Imaging Technical Documentation

Application Notes	Web Search Literature #
Image Processing Examples with the C62x™ DSP Generation Image/Video Processing Library (IMGLIB)	SPRA886
Image Processing Examples with the C64x™ DSP Generation Image/Video Processing Library (IMGLIB)	SPRA887
Performance Analysis of Face Recognition Algorithms on C64x DSPs	SPRA874
Real-Time Digital Video Transfer via High-Speed RTDX™	SPRA398
Wavelet Transforms in the TMS320C55x™ DSP Generation	SPRA800
Programming the VC5509 DSP Multi Media Controller in Native Mode	SPRA808
H.263 Encoder: TMS320C6000™ DSP Implementation	SPRA721
H.263 Decoder: TMS320C6000 DSP Implementation	SPRA703
Optimizing JPEG on the TMS320C6211 2-Level Cache DSP	SPRA705
TMS320C6000 DSP Platform JPEG Implementation	SPRA704
JPEG for Digital Panel on the TMS320C5000™ DSP Platform	SPRA664
Hardcopy Solutions, the HAVE Revolution and TI DSPs	SPRA652
Programmable DSP Platform for Digital Still Cameras	SPRA651
MPEG-2 Video Decoder: TMS320C62x DSP Implementation	SPRA649
On the Implementation of MPEG-4 Motion Compensation Using the TMS320C62x DSP Generation	SPRA586
A DSP-Based Three-Dimensional Graphics System	SPRA402
Digital Monopulse Doppler Radar and DSP Teaching	SPRA342

Application Notes (Cont'd)	Web Search Literature #
A DSP Kernel for On-Line Dynamic Handwritten Signature Verification Using TMS320™ DSPs	SPRA304
Front-End Processing for Monopulse Doppler Radar	SPRA299
Implementing the Color Space Transformation Algorithm Using the TMS320C2xx DSPs	SPRA364
DSP-Based Handprinted Character Recognition	SPRA143
High Resolution Video Using the DM642 DSP and the THS8200 Driver	SPRA961
Interfacing an LCD Controller to a DM642 Video Port	SPRA975
<b>Software Reference Guides</b>	
TMS320C62x DSP Image/Video Library Programmer's Reference	SPRU400
TMS320C64x DSP Image/Video Processing Library Programmer's Refer.	SPRU023
<b>Product Bulletins</b>	
Network Video Developer's Kit Product Bulletin	SPRT247
TMS320DM64x Digital Media Development Tools Product Bulletin	SPRT281
Video Development Platform Product Bulletin	SPRT344
Video Security over Internet Protocol (VSIP) Dev. Platform Product Bulletin	SPRT284
<b>Data Sheets</b>	
TMS320DM642 DSP Data Sheet	SPRS200
TMS320DM641/DM640 DSP Data Sheet	SPRS222
TMS320DM643 DSP Data Sheet	SPRS269

Check the TI website for a complete listing of technical documentation including application notes.



## Video and Imaging

### Video and Imaging Hardware and Software Development Tools

Description	Part Number	U.S.*
<b>Hardware Development Tools</b>		
TMS320DM642 Digital Media Development Kit (DM642 DMDK)	TMDSDMK642 (U.S. part number) TMDSDMK642-0E (European part number)	6,495
Network Video Developer's Kit (NVDK)	TMDXNVK6415-T (U.S. part number) TMDXNVK6415-TE (European part number)	4,495
Video Security over Internet Protocol Development Platform (VSIP) – NTSC format	TMDXVSK642 (U.S. part number)	15,000
VSIP Development Platform – PAL format	TMDXVSK642-0E (European part number)	
VSIP Development Platform with ATEME Emulator – NTSC format	TMDXVSK642-3 (U.S. part number)	16,000
VSIP Development Platform with ATEME Emulator – PAL format	TMDXVSK642-3E (European part number)	
Videophone Development Platform	TMDSVDP64X-2 (U.S. part number)	6,950
Network and Video Development Kit	TMDX3PNV6416S (U.S. part number)	4,495
Network and Video 1-GHz Development Kit	TMDXNVK6415-T (U.S. part number) TMDXNVK6415-TE (European part number)	4,495
<b>Evaluation Module (EVM)</b>		
TMS320DM642 Evaluation Module	TMDSEVM642 (U.S. part number) TMDSEVM642-0E (European part number)	1,995
<b>JTAG Emulators</b>		
XDS560™ PCI-Based High-Performance JTAG Emulator	TMDSEMU560	3,995
XDS560 Blackhawk USB High-Performance JTAG Emulator	TMDSEMU560U TMDSEMU560U-0E (European part number)	2,995
XDS510PP-Plus – Parallel Port Emulator for Windows	TMDSEMUPP (U.S. part number) TMDSEMUPP-0E (European part number)	1,500
XDS510™ USB-Based Emulator for Windows	TMDSEMUUSB	1,995
<b>Software Development Tools</b>		
Code Composer Studio Platinum Edition Development Tools Bundled with Annual S/W Subscription Supports C6000™, C5000™, C2000™ and OMAP™ platforms	TMDSCCSALL-1	3,595
C6000 DSP Code Composer Studio Development Tools Annual Software Subscription for Version 2.x	TMDSSUB6000	600
Essential Guide to Getting Started with DSP CD-ROM Includes C6000 DSP Code Composer Studio 120-Day Free Evaluation Tools†	SPRC119C ( <a href="http://www.dspvillage.ti.com/freetools">www.dspvillage.ti.com/freetools</a> )	Free
TMS320C62x™ DSP Image Library	SPRC093	Free
TMS320C64x™ DSP Image Library	SPRC094	Free

\* Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order. **New tools are listed in red.**

† Includes full-featured Code Composer Studio Development Tools, code generation tools (C/C++ compiler/assembler/linker) and simulator all limited to 120 days.

### Video and Imaging Integrated Solutions

For more information on TI's video and imaging solutions, go to [www.ti.com/videoandimaging](http://www.ti.com/videoandimaging)

**TMS320DM642 Evaluation Module (DM642 EVM)** – The DM642 EVM (part number TMDSEVM642) is a low-cost, high-performance video and imaging development platform designed to jump-start application development and evaluation of multi-channel and multi-format digital applications. Leveraging the high-performance TMS320C64x DSP core, this development platform supports TI's TMS320DM642, DM641 and DM640 digital media processors. This PCI form factor EVM is supported by award-winning eXpressDSP™ host tools and target software, allowing users to quickly and easily integrate eXpressDSP-compliant algorithms from over 100 TI third parties into the included starterware, accelerating evaluation and development of digital media solutions.

For more information, contact your authorized TI distributor or visit [www.ti.com/dm642720pr](http://www.ti.com/dm642720pr)



TMS320DM642 Evaluation Module

## Video and Imaging



*TMS320DM642 Digital Media Development Kit*

**Videophone Development Platform (VDP)** – A complete development platform for designing point-to-point IP-based videophone systems, the VDP (part number TMDSVDP64X-2) empowers OEMs to bring consumer videophones to market faster. The VDP is an integrated hardware/software solution reducing both design complexity and total system bill materials, including everything developers need to begin designing point-to-point videophone systems immediately. All application system software runs on TI's 600-MHz DSP-based TMS320DM643 digital media processor, including audio/video compression, networking stacks and control protocols. The VDP includes two DSP-based boards, two CCD cameras, two 5-inch LCD displays, two phone keypads as well as the software and documentation to get started.

For more information, contact your TI sales representative or authorized TI distributor or visit [www.ti.com/vdp](http://www.ti.com/vdp)



*Network Video Developer's Kit*

**TMS320DM642 Digital Media Development Kit (DM642 DMDK)** – The DMDK allows immediate development of multi-channel, multi-format digital media applications or other future-ready, high-performance video and imaging applications. Loaded with starterware, supported by eXpressDSP™ host tools and target software and offered at an exceptional price/performance ratio, the DMDK (part number TMDXDMK642) is a comprehensive, fully integrated development platform and an easy-to-use, robust tool suite. Based on the high-performance TMS320C64x™ DSP core, this development platform supports TI's DM642, DM641 and DM640 digital media processors. The DMDK is ideal for developers who have minimal experience with DSP as well as developers who are experienced with programmable DSPs and want to add multimedia functionality to an existing or new product/system.

For more information, contact your authorized TI distributor or visit [www.ti.com/dm64xdevkit](http://www.ti.com/dm64xdevkit)



*Videophone Development Platform*

**Network Video Developer's Kit (NVDK)** – Powered by ultra-high performance C64x™ DSP technology, the NVDK (part number TMDXNVK6415-T) gives designers a complete and cost effective way to speed to market next-generation digital media applications. The NVDK provides all the hardware and software required for developing imaging and video applications, including those requiring network connectivity. The NVDK addresses video/imaging customers' most pressing needs, including full software programmability, fast time-to-market and optimum system cost. The NVDK includes: an ATEME TMS320C6415 DSP video board, 10-/100-Mbps Ethernet daughter card, audio/video interface box, power supply and a CD-ROM with schematics, drivers for PCI board support library and application samples and executable code demonstrations.

For more information, contact your TI sales representative or authorized TI distributor or visit [www.ti.com/nvdk](http://www.ti.com/nvdk)



## Video and Imaging



VSIP Development Platform

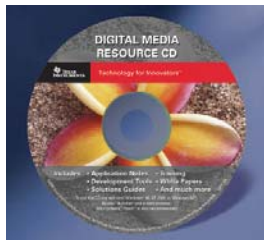
### Video Security over Internet Protocol (VSIP) Development Platform

– The VSIP development platform enables developers to build intelligent security cameras that take advantage of a digital IP network by leveraging the real-time performance and flexibility inherent in DSP technology.

Offering the flexibility of a programmable DSP solution, the VSIP development platform allows developers to change compression standards, add specific processing capabilities and develop different products on the same hardware platform – enabling a wide range of products and creating a future-proof system.

### Additional Resources

#### Free Digital Media Resource CD



Jump-start your design with TI solutions for your entire signal chain. From industry-leading, DSP-based, digital media processors and high-performance analog to logic and an extended portfolio of application software, TI delivers reliable, scalable and power-efficient

video and imaging solutions. Go to [www.ti.com/digitalmediacd](http://www.ti.com/digitalmediacd) to order your free copy.

#### Video and Imaging Solutions Guide

Explore TI's solutions for a wide variety of video and imaging applications in this comprehensive guide. TI's Video and Imaging Solutions Guide contains over 70 pages of valuable video and imaging information for your design needs. Find out everything you need to know in this complete guide that includes system



Using the VSIP development platform, developers can leverage advanced digital functionality by incorporating this function directly into a standalone IP camera or by incorporating functionality into a network encoder that supplies digital intelligence for multiple standard analog surveillance cameras. In the latter scenario, developers benefit from the ability to use existing cameras without the expense of replacing them with new ones.

The VSIP includes all the hardware, software and tools needed to create a fully digital system for the encoding and transmission of camera surveillance information.

The development platform is among the first to offer MPEG-4 compression, the latest and most efficient of the MPEG video compression algorithms, designed to minimize bandwidth requirements in network video transmission. Since the VSIP is an application-oriented, open platform, it is not necessary for developers to have a deep understanding of DSP programming techniques. Moreover, application software from developers and third parties is easy to integrate, allowing straightforward customization for market differentiation.

For more information, contact your authorized TI distributor or visit [www.ti.com/vsipinfo](http://www.ti.com/vsipinfo)

block diagrams, product information, benchmarks, development tools, software, support and various other resources.

[www.ti.com/visolutionsguide](http://www.ti.com/visolutionsguide)

#### Subscribe to Digital Media eNewsletter

TI's technologies and resources allow you to design high-end to low-cost video/imaging products with DSP-based solutions. Subscribe to the monthly Digital Media eNewsletter to receive the latest TI technology releases, informative documentation, time-saving training and other useful tips and tricks to get your design to market quickly. Go to [www.ti.com/digitalmediafocus](http://www.ti.com/digitalmediafocus) to subscribe.





### Power Management Products for the TMS320DM64x™ DSP Generation

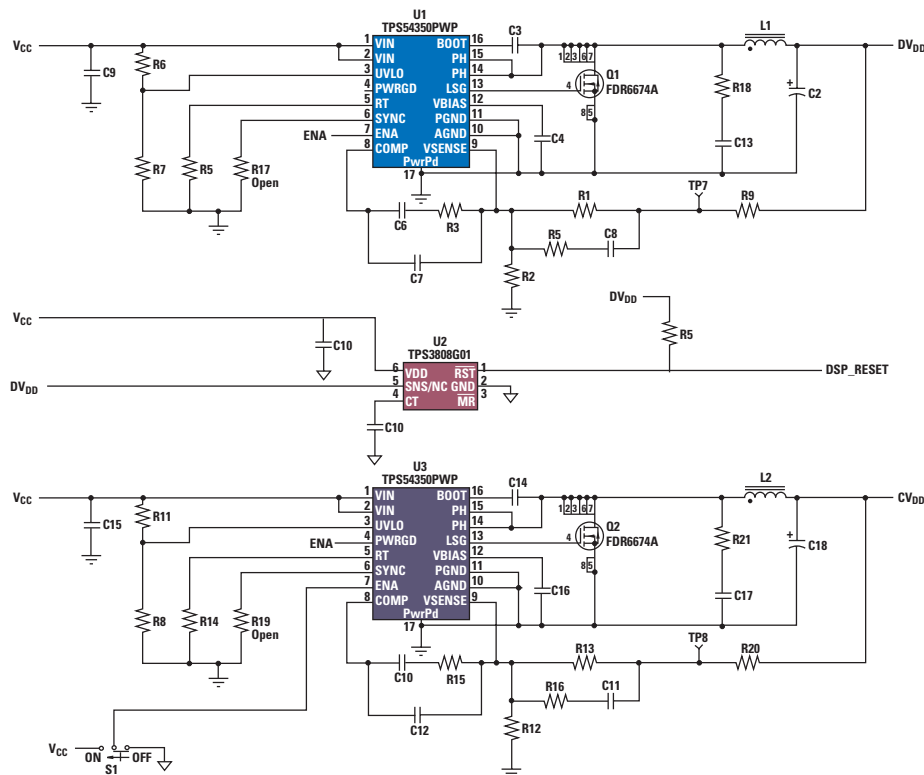
Get samples, datasheets, Evaluation Modules (EVMs) and app reports at: [power.ti.com](http://power.ti.com)

#### Suggested Power Management Solutions for the TMS320DM64x Digital Media Processor Generation

DSP Part Number	Core	Core Switcher	Core Plug-In	Dual Plug-In	I/O LDO	I/O Switcher
3.3-V I/O (Core)	LDO	(w/ FETs)	Module	Module		(w/ FETs)
TMS320DM640-400 (1.2 V)	TPS79601	TPS62040	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320DM641-500 (1.2 V)	TPS79601	TPS62040	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320DM641-600 (1.4 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320DM642-500 (1.2 V)	TPS79601	TPS62040	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320DM642-600 (1.4 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320DM642-720 (1.4 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320DM643-500 (1.2 V)	TPS79601	TPS62040	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320DM643-600 (1.4 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007

**Note 1:** xx is determined by input bus voltage:  $V_{IN} = 12\text{ V}$  then  $xx = 12$ ,  $V_{IN} = 5\text{ V}$  then  $xx = 05$ , and  $V_{IN} = 3.3\text{ V}$  then  $xx = 03$ .

#### Example TMS320C6000™ DSP Power Supply Design



For additional power supply designs for TI DSPs, please visit [www.ti.com/dspower](http://www.ti.com/dspower).

**Note:** The TI power devices recommended here are based on standard operating conditions. System designers should use device power estimation tools in conjunction with overall application level power requirements to ensure an adequate power supply design is used.



## Overview

DSP usage has become very diversified—from communications infrastructure to handheld, portable appliances. TI has worked with its customers and third parties to deliver DSP core architectures that are well established and optimized for diverging combinations of power-performance needs.

### Advantages of Designing with DSPs Over Other Architectures

- Multiple multiply-accumulate operations per cycle
- Real-time performance, simulation and emulation
- Flexibility
- Reliability
- Increased system performance
- Reduced system cost

### Advantages of TMS320 DSPs Over the Competition

- Highest performance DSPs
- Lowest power DSPs
- eXpressDSP™ Software and Development Tools: Industry award-winning, open software development tools
- Market leaders in compatible analog and mixed signal solutions
- Manufacturing strength and commitment
- Wide variety of packaging options
- Better support from concept to completion
- Low-cost starter kits and evaluation modules
- Cycle-accurate simulators
- Optimizing high-level language compilers
- Feature-rich integrated development environment
- Real-time scan-based emulators
- Application software library
- Technical hotline
- Largest Third Party Network in the DSP industry

Today, TI ships the highest-performance, most power-efficient, and control-optimized DSPs with roadmaps going beyond any competitive solution. And TI's commitment to code compatibility for each platform ensures your investment in software development will not be discarded when it's time to upgrade. The TMS320 DSP family delivers the most extensive selection of DSPs with three distinct architectures:

### MCU-Like Control, DSP Performance

The TMS320C2000™ digital signal controller platform combines the control peripheral integration and ease of use of a microcontroller (MCU) and the processing power and C efficiency of TI's leading DSP technology.

- **TMS320C28x™ Digital Signal Controller Generation** – includes industry's first 32-bit DSP-based controllers with on-board Flash memory and performance up to 150 MIPS. Pin-compatible ROM versions also available
- **TMS320C24x™ Digital Signal Controller Generation** – offers 20 to 40 MIPS of performance with highly integrated Flash memory, control and communication peripherals. Get started at sub U.S. \$2.00 (in quantities). Pin-compatible ROM versions also available

### Most Power Efficient

The TMS320C5000™ DSP platform is optimized for the consumer digital market – the heart of the mobile Internet – and its convergence with communications electronics.

- **TMS320C55x™ DSPs** – industry's most power-efficient DSPs and ultra-low stand-by power. Advanced power management techniques automatically power down inactive peripherals, memory and core functional units increasing battery life
- **TMS320C54x™ DSPs** – offers a broad range of performance and peripheral options
- **OMAP™ Processors** – integrate a C55x™ DSP core with an ARM® processor on a single chip

### Highest Performance

The TMS320C6000™ DSP platform is optimized for highest performance, value and ease-of-use in high-level language programming. The C6000™ fixed- and floating-point DSPs anchor multi-service broadband infrastructure, video, performance audio and imaging applications. The C6000 platform includes:

- **TMS320C64x™ DSPs** – industry's highest-performance DSPs offer clock speeds up to 1 GHz and reduced system cost through peripheral integration
- **TMS320C62x™ DSPs** – offer cost-effective solutions to high-performance DSP programming challenges
- **TMS320C67x™ floating-point DSPs** – offer precision, speed, power savings and dynamic range with performance ranging from 600–1800 MFLOPS

### Applications Matrix Guideline

	C2000™ DSP	C5000™ DSP	C6000 DSP	OMAP
Audio	•	•	•	•
Biometrics		•	•	•
Digital Control	•	•		
Telecom	•	•	•	•
Video and Imaging			•	•

### Easy-to-Use Software and Development Tools

For accelerated DSP product development, the TMS320 DSP family is supported by eXpressDSP™ Software and Development Tools. This includes Code Composer Studio™ Development Tools, DSP/BIOS™ kernel and the TMS320 DSP Algorithm Standard as well as numerous options for reusable, modular software from the largest Third Party Network in the industry.



## TMS320C28x™ Controller Generation, Fixed Point

MCU Control. DSP Performance

Get samples, datasheets, tools and app reports at: [www.ti.com/c2000](http://www.ti.com/c2000)

### Specifications

- 32-bit, fixed-point C28x™ DSP core
- Up to 150-MIPS operation
- 1.8-/1.9-V core and 3.3-V peripherals
- Easy-to-use software and development tools speed time-to-market

### Applications

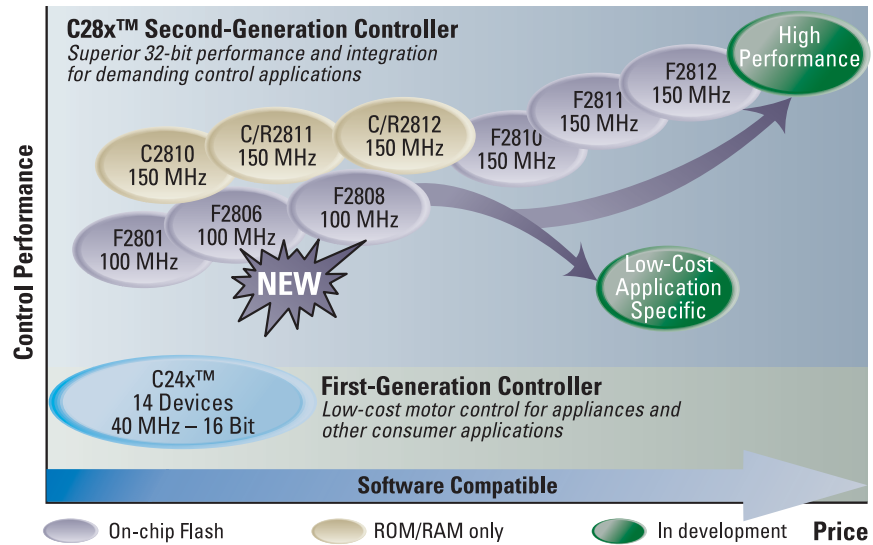
Digital motor control, digital power supply and advanced sensing in industrial, automotive, medical and consumer markets

### Features

- Ultra-fast 20–40 ns service time to any interrupts
- Powerful 20 Mbit/s data logging debug capability
- 32-/64-bit saturation, single-cycle read-modify-write instructions, and 64-/32-bit and 32-/32-bit modulus division
- Enhanced tool suites with C and C++ support
- Unique real-time debugging capabilities
- 32 × 32-bit single-cycle fixed-point MAC
- Dual 16 × 16-bit single-cycle fixed-point MACs
- Supported by 16-bit instructions for improved code efficiency
- Compatible with TMS320C24x™ DSP and TMS320C2xLP™ source code

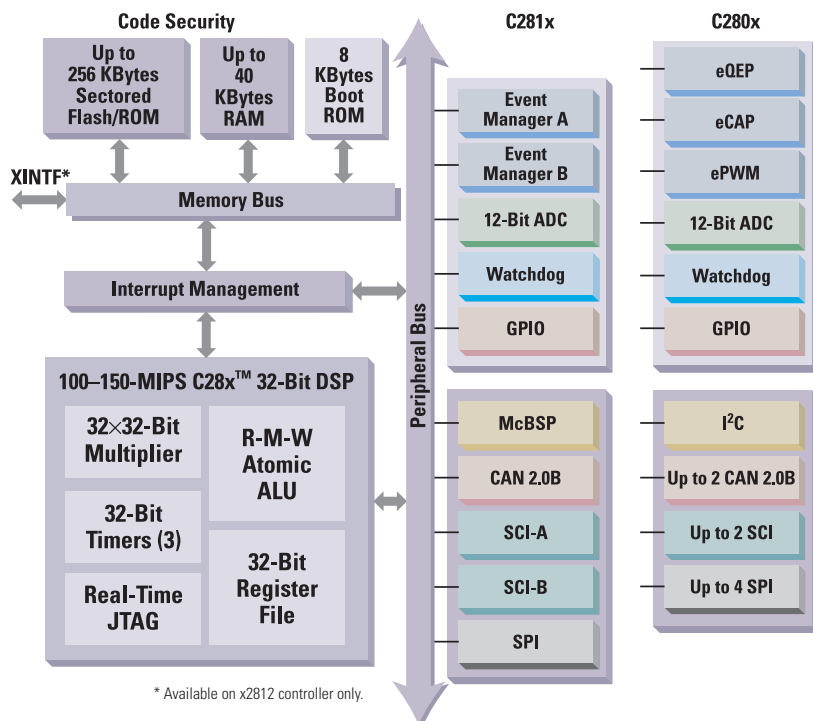
### Peripherals

- 16 to 128 Kwords sectored Flash or factory programmed ROM (with code security)
- 12-bit A/D, as fast as 12.5-MSPS throughput with 80-ns minimum conversion time
- Flexible QEP, CAP, timers and PWM generation
- High-res mode resolution of 16 bits @ 100 KHz and over 12 bits @ 1.5-MHz ePWM frequency
- Up to two serial communication interfaces (SCI / UART)
- Up to four serial peripheral interfaces (SPI)
- Up to two enhanced CAN 2.0B modules
- McBSP or I<sup>2</sup>C



### TMS320C2000 Digital Signal Controller Platform Roadmap

The C2000™ controller platform provides an optimized combination of DSP performance and MCU integration for digital control systems.



### TMS320C28x Digital Signal Controller Block Diagram

The C28x controllers are the industry's first 32-bit control-based DSPs with onboard reprogrammable Flash, factory programmed ROM, or cost effective RAM-only memory options and performance from 100 to 150 MIPS.



Silicon

## TMS320C28x™ Controller Generation

Device <sup>§</sup>	MIPS	Boot ROM	RAM	Flash/ROM	Timers	CAP/QEP	# PWM Channels	# HiRes PWM	12-Bit A/D Chs/ Conversion Time (ns)	EMIF	WD Timer	Comm Ports				I/O Pins	Core Voltage (V)	Packaging	1 KU (\$U.S.) <sup>†</sup>
												Other	SPI	SCI	CAN				
<b>Flash Devices</b>																			
TMS320F2801-PZA/S/Q <sup>§</sup>	100	8 KB	12 KB	32 KB	9	2/1	6 + 2	3	16 ch/160	–	Y	I <sup>2</sup> C	2	1	1	32	1.8	100 LQFP	5.79 <sup>†</sup>
TMS320F2801-GGMA/S/Q <sup>§</sup>	100	8 KB	12 KB	32 KB	9	2/1	6 + 2	3	16 ch/160	–	Y	I <sup>2</sup> C	2	1	1	32	1.8	100 BGA	5.79 <sup>†</sup>
TMS320F2806-PZA/S/Q <sup>§</sup>	100	8 KB	20 KB	64 KB	15	4/2	12 + 4	4	16 ch/160	–	Y	I <sup>2</sup> C	4	2	1	32	1.8	100 LQFP	8.69 <sup>†</sup>
TMS320F2806-GGMA/S/Q <sup>§</sup>	100	8 KB	20 KB	64 KB	15	4/2	12 + 4	4	16 ch/160	–	Y	I <sup>2</sup> C	4	2	1	32	1.8	100 BGA	8.69 <sup>†</sup>
TMS320F2808-PZA/S/Q <sup>§</sup>	100	8 KB	36 KB	128 KB	15	4/2	12 + 4	4	16 ch/160	–	Y	I <sup>2</sup> C	4	2	2	32	1.8	100 LQFP	11.52 <sup>†</sup>
TMS320F2808-GGMA/S/Q <sup>§</sup>	100	8 KB	36 KB	128 KB	15	4/2	12 + 4	4	16 ch/160	–	Y	I <sup>2</sup> C	4	2	2	32	1.8	100 BGA	11.52 <sup>†</sup>
TMS320F2810-PBKA/S/Q <sup>§</sup>	150	8 KB	36 KB	128 KB	7	6/2	16	–	16 ch/80	–	Y	McBSP	1	2	1	56	1.9	128 LQFP	13.81
TMS320F2811-PBKA/S/Q <sup>§</sup>	150	8 KB	36 KB	256 KB	7	6/2	16	–	16 ch/80	–	Y	McBSP	1	2	1	56	1.9	128 LQFP	14.73
TMS320F2812-GHHA/S/Q <sup>§</sup>	150	8 KB	36 KB	256 KB	7	6/2	16	–	16 ch/80	Y	Y	McBSP	1	2	1	56	1.9	179 BGA	15.65
TMS320F2812-PGFA/S/Q <sup>§</sup>	150	8 KB	36 KB	256 KB	7	6/2	16	–	16 ch/80	Y	Y	McBSP	1	2	1	56	1.9	176 LQFP	15.65
<b>RAM-Only Devices</b>																			
TMS320R2811-PBKA/Q <sup>§</sup>	150	8 KB	40 KB	–	7	6/2	16	–	16 ch/80	–	Y	McBSP	1	2	1	56	1.9	128 LQFP	9.11
TMS320R2812-GHHA/Q <sup>§</sup>	150	8 KB	40 KB	–	7	6/2	16	–	16 ch/80	Y	Y	McBSP	1	2	1	56	1.9	179 BGA	10.63
TMS320R2812-PGFA/Q <sup>§</sup>	150	8 KB	40 KB	–	7	6/2	16	–	16 ch/80	Y	Y	McBSP	1	2	1	56	1.9	176 LQFP	10.63
<b>ROM Devices</b>																			
TMS320C2810-PBKA/Q <sup>§</sup>	150	8 KB	36 KB	128 KB	7	6/2	16	–	16 ch/80	–	Y	McBSP	1	2	1	56	1.9	128 LQFP	7.05 <sup>♦</sup>
TMS320C2811-PBKA/Q <sup>§</sup>	150	8 KB	36 KB	256 KB	7	6/2	16	–	16 ch/80	–	Y	McBSP	1	2	1	56	1.9	128 LQFP	8.22 <sup>♦</sup>
TMS320C2812-GHHA/Q <sup>§</sup>	150	8 KB	36 KB	256 KB	7	6/2	16	–	16 ch/80	Y	Y	McBSP	1	2	1	56	1.9	179 BGA	9.59 <sup>♦</sup>
TMS320C2812-PGFA/Q <sup>§</sup>	150	8 KB	36 KB	256 KB	7	6/2	16	–	16 ch/80	Y	Y	McBSP	1	2	1	56	1.9	176 LQFP	9.59 <sup>♦</sup>

<sup>†</sup> Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order.

<sup>§</sup> A = –40° to 85°C; S = –40 to 125°C (10% adder over A); Q = –40 to 125°C, Q100 qualified (15% adder over S)

All devices are available in PB-Free Green packaging.

<sup>♦</sup> Minimum volumes for C281x devices are 10 KU with NRE of \$11,000.

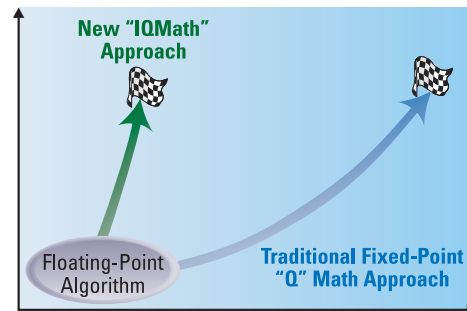
<sup>†</sup> Production scheduled for 3Q05.

### IQMath: Develop in Easy-to-Use Floating Point on a Cost-Effective, Fixed-Point Machine

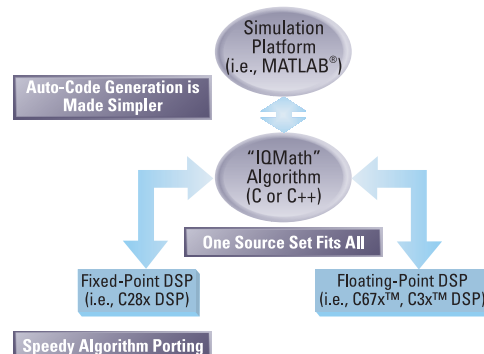
Control algorithms typically start life in a floating-point format. Until now, the conversion of such algorithms to run on a fixed-point machine was laborious and time consuming. TI's C28x™ IQMath Library makes this task easier, faster and enables:

- Seamless portability of code between fixed- and floating-point devices
- One source code set for simulation vs. target device
- Numerical resolution adjustability based on application requirement
- Numerical accuracy without sacrificing time and cycles
- Rapid conversion/porting and implementation of algorithms

For more information, visit [www.ti.com/iqmath](http://www.ti.com/iqmath)



Slash development time and reduce overall costs with TI's IQMath: floating-point development on a fixed-point machine.



TI's C28x IQMath Library makes code development easier, faster and enables seamless portability of code between fixed- and floating-point devices.



## TMS320C24x™ Controller Generation, Fixed Point

MCU Control. DSP Performance

Get samples, datasheets, tools and app reports at: [www.ti.com/c2000](http://www.ti.com/c2000)

### Specifications

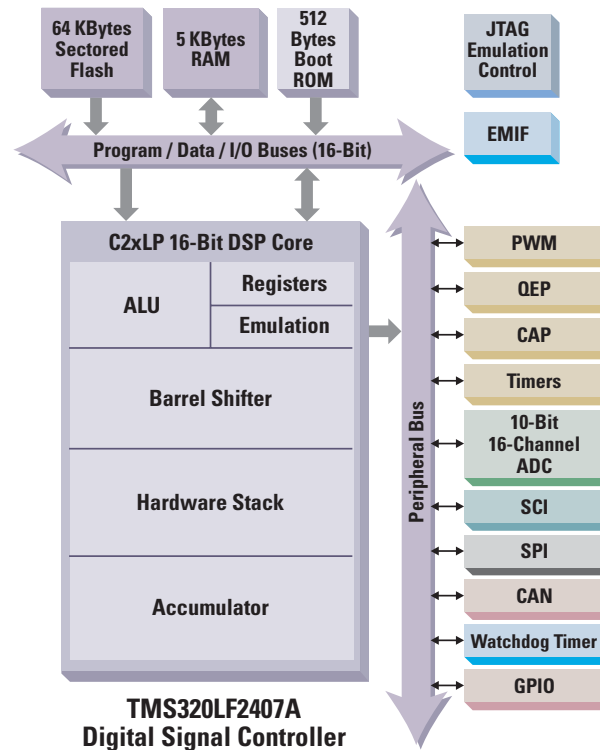
- Up to 40-MIPS operation
- Three power-down modes
- Code-compatible, control-optimized DSPs
- JTAG scan-based emulation
- 3.3-V and 5-V designs

### Applications

- Appliances/white goods, industrial automation, power conversion, metering, office equipment, sensing

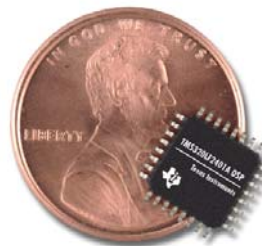
### Features and Peripherals

- 375-ns (minimum conversion time) analog-to-digital (A/D) converter
- Deadband logic
- Dual 10-bit A/D converters
- Up to four 16-bit general-purpose timers
- Watchdog timer module
- Up to 16 PWM channels
- Up to 41 GPIO pins
- Five external interrupts
- Up to two event managers
- Up to 32K words on-chip sectored Flash
- Controller Area Network (CAN) interface module
- Serial communications interface (SCI)
- Serial peripheral interface (SPI)
- Up to six capture units (four with QEP)
- Boot ROM (LF240xA devices)
- Code security for on-chip Flash/ROM (Lx240xA devices)



### TMS320LF2407A Digital Signal Controller Block Diagram

For high-performance industrial applications, the Flash-based LF2407A digital signal controller includes peripherals such as a controller area network (CAN) module to enable control of multiple motors by a single DSP-based controller.



### TMS320LF / C2401A Digital Signal Controllers: For Space-Constrained Designs

The TMS320LF/C2401A controllers pack a tremendous amount of power in an unbelievably small package. In only 49 mm<sup>2</sup>, the TMS320LF/C2401A controllers provide 40 MIPS of processing power with 500-ns conversion time, 8 Kw of sectored memory with code security and much more.



Silicon

## TMS320C24x™ Controller Generation

Device	RAM	ROM	Flash	Boot ROM	EMIF	General-Purpose Timers	Watchdog Timer	PWM Channels	SPI	SCI	CAN	10-Bit A/D Channels	I/O Pins	Voltage (V)	MIPS	Packaging	1 KU (U.S.) <sup>†</sup>
												Conversion Time (μs)					
TMS320LC2401AVFA <sup>‡</sup>	2 KB	16 KB	–	–	–	2	Y	7	–	Y	–	5 ch 0.5	13	3.3	40	32 LQFP	1.99 <sup>‡</sup>
TMS320LC2402APGA <sup>‡</sup>	1 KB	12 KB	–	–	–	2	Y	8	–	Y	–	8 ch 0.425	21	3.3	40	64 PQFP	2.60 <sup>‡</sup>
TMS320LC2402APAGA <sup>‡</sup>	1 KB	12 KB	–	–	–	2	Y	8	–	Y	–	8 ch 0.425	21	3.3	40	64 LQFP	2.60 <sup>‡</sup>
TMS320LC2403APAGA <sup>‡</sup>	2 KB	32 KB	–	–	–	2	Y	8	Y	Y	Y	8 ch 0.425	21	3.3	40	64 LQFP	3.95 <sup>‡</sup>
TMS320LC2404APZA <sup>‡</sup>	3 KB	32 KB	–	–	–	4	Y	16	Y	Y	–	16 ch 0.375	41	3.3	40	100 LQFP	4.51 <sup>‡</sup>
TMS320LC2406APZA <sup>‡</sup>	5 KB	64 KB	–	–	–	4	Y	16	Y	Y	Y	16 ch 0.375	41	3.3	40	100 LQFP	5.19 <sup>‡</sup>
TMS320LF2401AVFA	2 KB	–	16 KB	512 B	–	2	Y	7	–	Y	–	5 ch 0.5	13	3.3	40	32 LQFP	3.49
TMS320LF2402APGA <sup>°</sup>	2 KB	–	16 KB	512 B	–	2	Y	8	–	Y	–	8 ch 0.5	21	3.3	40	64 PQFP	7.09
TMS320LF2403APAGA <sup>°</sup>	2 KB	–	32 KB	512 B	–	2	Y	8	Y	Y	Y	8 ch 0.5	21	3.3	40	64 LQFP	8.21
TMS320LF2406APZA <sup>°</sup>	5 KB	–	64 KB	512 B	–	4	Y	16	Y	Y	Y	16 ch 0.5	41	3.3	40	100 LQFP	8.33
TMS320LF2407APGEA <sup>°</sup>	5 KB	–	64 KB	512 B	Y	4	Y	16	Y	Y	Y	16 ch 0.5	41	3.3	40	144 LQFP	8.83
TMS320C242PGA <sup>§</sup>	1 KB	8 KB	–	–	–	2	Y	8	–	Y	–	8 ch 0.9	26	5	20	64 PQFP	3.62 <sup>‡*</sup>
TMS320C242FNA <sup>§</sup>	1 KB	8 KB	–	–	–	2	Y	8	–	Y	–	8 ch 0.9	26	5	20	38 PLCC	3.62 <sup>‡*</sup>
TMS320F241PGA <sup>§</sup>	1 KB	–	16 KB	–	–	2	Y	8	Y	Y	Y	8 ch 0.9	26	5	20	64 PQFP	11.16
TMS320F241FNA <sup>§</sup>	1 KB	–	16 KB	–	–	2	Y	8	Y	Y	Y	8 ch 0.9	26	5	20	68 PLCC	13.36
TMS320F243PGEA <sup>§</sup>	1 KB	–	16 KB	–	Y	2	Y	8	Y	Y	Y	8 ch 0.9	32	5	20	144 LQFP	13.99
TMS320F240PQA <sup>§</sup>	1 KB	–	32 KB	–	Y	3	Y	12	Y	Y	–	16 ch 6.1	28	5	20	132 PQFP	16.21

<sup>†</sup> Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order.

<sup>\*</sup> Pricing based on 5 KU minimum requirements due to factory ROM code.

<sup>‡</sup> Minimum volume for LC240xA devices is 10 KU with NRE of \$9,000.

<sup>§</sup> Not recommended for new designs.

<sup>°</sup> Available in industrial temperature range (A = –40 to 85°C) or extended temperature range (S = –40 to 125°C) (with 10% price adder).

**C2000™ Controller Platform Hardware and Software Development Tools**

Description	Part #	\$U.S.*
<b>Starter Kits</b>		
LF2407A eZdsp™ Starter Kit°	TMDSEZD2407 (U.S. part number) TMDSEZD2407-0E (European part number)	345
LF2401A eZdsp Starter Kit°	TMDSEZD2401 (U.S. part number) TMDSEZD2401-0E (European part number)	595
F2812 eZdsp Starter Kit°	TMDSEZD2812 (U.S. part number) TMDSEZD2812-0E (European part number)	395
Includes parallel port cable, User's Guide, Code Composer Studio™ (CCStudio) IDE for eZdsp, power supply	TMDSEZD2812-0E (European part number)	
F2812 eZdsp Starter Kit° (Socketed)	TMDSEZS2812 (U.S. part number) TMDSEZS2812-0E (European part number)	495
Includes parallel port cable, User's Guide, CCStudio IDE for eZdsp, power supply	TMDSEZS2812-0E (European part number)	
F2808 eZdsp Starter Kit° (Socketed)	TMDXEZS2808 (U.S. part number) TMDXEZS2808-0E (European part number)	495
Includes USB cable, User's Guide, CCStudio IDE for eZdsp, power supply	TMDXEZS2808-0E (European part number)	
<b>Evaluation Modules</b>		
LF2407A Evaluation Module (EVM), CCStudio IDE, XDS510PP-Plus Emulator <sup>§</sup>	TMDS3P701016A (U.S. part number) TMDS3P701016AE (European part number)	1,995
F2812 Development Bundle <sup>§</sup>	TMDSEVP2812 (U.S. part number) TMDSEVP2812-0E (European part number)	1,995
Includes eZdsp (socketed), CCStudio IDE, XDS510PP-Plus	TMDSEVP2812-0E (European part number)	
F2812 Development Bundle <sup>§</sup>	TMDSEVU2812 (U.S. part number) TMDSEVU2812-0E (European part number)	2,295
Includes eZdsp (socketed), CCStudio IDE, XDS510™ USB Emulator	TMDSEVU2812-0E (European part number)	
<b>JTAG Emulators</b>		
XDS510PP-Plus Parallel Port Pod with JTAG Cable for Windows	TMDSEMUPP (U.S. part number) TMDSEMUPP-0E (European part number)	1,500
XDS510 USB-Based Emulator for Windows	TMDSEMUUSB	1,995
XDS560™ PCI-Based High-Performance JTAG Emulator	TMDSEMU560	3,995
XDS560 Blackhawk USB High-Performance JTAG Emulator	TMDSEMU560U (U.S. part number) TMDSEMU560U-0E (European part number)	2,995
<b>Software Development Tools</b>		
C2000 DSP Code Composer Studio Development Tools Bundled with Annual Software Subscription Supports TMS320C24x™ and TMS320C28x™ DSP products	TMDS320C2000-1	495
C2000 DSP Code Composer Studio Development Tools Annual Software Subscription for Version 2.x	TMDS320C2000	495
Code Composer Studio Platinum Edition Development Tools bundled with Annual Software Subscription Supports C6000™, C5000™, C2000 and OMAP™ platforms	TMDS320C2000-1	3,595
Essential Guide to Getting Started with DSP CD-ROM Includes C2000 DSP Code Composer Studio 120-Day Free Evaluation Tools <sup>‡</sup>	SPRC119C <a href="http://www.dspvillage.ti.com/freetools">www.dspvillage.ti.com/freetools</a>	Free
TMS320C2000 Flash Programming Utilities	<a href="http://www.ti.com/c2000flashtools">www.ti.com/c2000flashtools</a>	Free
TMS320C2000 Application Software	<a href="http://www.ti.com/c2000appsw">www.ti.com/c2000appsw</a>	Free
TMS320C2000 Signal Processing Libraries	<a href="http://www.ti.com/c2000sigproclib">www.ti.com/c2000sigproclib</a>	Free

\* Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order.

<sup>§</sup> Includes Code Composer Studio integrated development environment (IDE), code generation tools with C compiler/assembler/linker, target board and device drivers.

<sup>‡</sup> Includes full-featured Code Composer Studio Development Tools, code generation tools (C/C++ compiler/assembler/linker), emulator and simulator configurations all limited to 120 days.

<sup>°</sup> Includes board-specific Code Composer™ IDE, code-generation tools, on-board JTAG emulation, target board and target-specific device driver.

Alternative Development Tools are available from third parties such as EWA Blackhawk DSP ([www.blackhawk-dsp.com](http://www.blackhawk-dsp.com)), Spectrum Digital ([www.spectrumdigital.com](http://www.spectrumdigital.com)), Technosoft ([www.technosoft.ch](http://www.technosoft.ch)) and Softronix ([www.softronix.com](http://www.softronix.com)).

Please see the features supported by platform matrix on page 61 for more details.

**C2000 Controller Literature and Related Technical Documentation**

All documentation and associated literature, user's guides, application notes and software can be found by clicking on the specific device in the parametric table found on the URLs below.

TMS320C28x™ Controller Generation

[www.ti.com/c28x](http://www.ti.com/c28x)

TMS320C24x™ Controller Generation

[www.ti.com/c24x](http://www.ti.com/c24x)



## Tools, Software and Support

### Motor-Specific Software Solutions [www.ti.com/c2000appsw](http://www.ti.com/c2000appsw)

System	Motor Type	Sensored	Sensorless	Description	C24x™ Controller	C28x™ Controller
ACI1_1	1 ph AC Induction	•		Tacho I/P VHz / SinePWM/ Closed Loop (CL) Speed PID	•	
ACI3_1	3 ph AC Induction	•		Tacho I/P VHz / SinePWM / CL Speed PID	•	•
ACI3_2	3 ph AC Induction		•	MRAS (Speed Estimator) VHz / SinePWM / CL Speed PID	•	
ACI3_3	3 ph AC Induction	•		Tacho I/P FOC / SinePWM / CL Current PID for D, Q / CL Speed PID	•	•
ACI3_4	3 ph AC Induction		•	Direct Flux Estimator + Speed Estimator FOC / SinePWM / CL Current PID for D, Q / CL Speed PID	•	•
PMSM3_1	3 ph Permanent Magnet Synch	•		QEP FOC / SinePWM / CL Current PID for D, Q / CL Speed PID	•	•
PMSM3_2	3 ph Permanent Magnet Synch		•	SMO (Sliding Mode Observer) Position Estimator FOC / SinePWM / CL Current PID for D, Q / CL Speed PID	•	•
PMSM3_3	3 ph Permanent Magnet Synch	•		Resolver / FOC / CL Current PID for D, Q / CL Speed PID		•
PMSM3_4	3 ph Permanent Magnet Synch	•		QEP / FOC / Position Control		•
BLDC3_1	3 ph Trapezoidal Brushless DC	•		3 Hall Effect I/P Trapezoidal / CL Loop Current PID / CL Speed PID	•	•
BLDC3_2	3 ph Trapezoidal Brushless DC		•	BEMF / Zero Crossing Detection Trapezoidal / CL Loop Current PID / CL Speed PID	•	•
DCMOTOR	Brushed DC	•		Speed & Position / QEP without Index		•
Digital Motor Control Library	All Motor Types	•	•	Component Modules for Motor-Specific Applications	•	•



### Power Management Products for the C2000™ Controller Platform

Get samples, datasheets, Evaluation Modules (EVMs) and app reports at: [power.ti.com](http://power.ti.com)

Suggested Texas Instruments Power Management Solutions for the TMS320C24x™ Controller Generation					
DSP Part Number		8–40 V <sub>IN</sub>	9–26 V <sub>IN</sub>	5 V <sub>IN</sub>	5 V <sub>IN</sub>
3.3 V	LDO	Controller	Plug-In Module	Converter	Plug-In Module
TMS320LC2401A	REG103-33	TPS40054	PT5103	TPS54316	PTHxx050W <sup>2</sup>
TMS320LC2402A	REG103-33	TPS40054	PT5103	TPS54316	PTHxx050W <sup>2</sup>
TMS320LC2403A	REG103-33	TPS40054	PT5103	TPS54316	PTHxx050W <sup>2</sup>
TMS320LC2404A	REG103-33	TPS40054	PT5103	TPS54316	PTHxx050W <sup>2</sup>
TMS320LC2406A	REG103-33	TPS40054	PT5103	TPS54316	PTHxx050W <sup>2</sup>
TMS320LF2401A	REG103-33	TPS40054	PT5103	TPS54316	PTHxx050W <sup>2</sup>
TMS320LF2402A	REG103-33	TPS40054	PT5103	TPS54316	PTHxx050W <sup>2</sup>
TMS320LF2403A	REG103-33	TPS40054	PT5103	TPS54316	PTHxx050W <sup>2</sup>
TMS320LF2406A	REG103-33	TPS40054	PT5103	TPS54316	PTHxx050W <sup>2</sup>
TMS320LF2407A	REG103-33	TPS40054	PT5103	TPS54316	PTHxx050W <sup>2</sup>

Suggested Texas Instruments Power Management Solutions for the TMS320C28x™ Controller Generation						
DSP Part Number	LDO	Dual LDO	8–40 V <sub>IN</sub>	9–26 V <sub>IN</sub>	3.3/5 V <sub>IN</sub>	5 V <sub>IN</sub>
			Controller	Plug-In Module	Converter	Plug-In Module
TMS320F2801 (1.8 V)	TPS79501	TPS70102	TPS40054	PT5103	TPS54110	PTHxx050W <sup>2</sup>
TMS320F2806 (1.8 V)	TPS79501	TPS70102	TPS40054	PT5103	TPS54110	PTHxx050W <sup>2</sup>
TMS320F2808 (1.8 V)	TPS79501	TPS70102	TPS40054	PT5103	TPS54110	PTHxx050W <sup>2</sup>
TMS320C2810 (1.9 V)	TPS79501	TPS70102	TPS40054	PT5103	TPS54110	PTHxx050W <sup>2</sup>
TMS320C2811 (1.9 V)	TPS79501	TPS70102	TPS40054	PT5103	TPS54110	PTHxx050W <sup>2</sup>
TMS320C2812 (1.9 V)	TPS79501	TPS70102	TPS40054	PT5103	TPS54110	PTHxx050W <sup>2</sup>
TMS320F2810 (1.9 V)	TPS79501	TPS70102	TPS40054	PT5103	TPS54110	PTHxx050W <sup>2</sup>
TMS320F2811 (1.9 V)	TPS79501	TPS70102	TPS40054	PT5103	TPS54110	PTHxx050W <sup>2</sup>
TMS320F2812 (1.9 V)	TPS79501	TPS70102	TPS40054	PT5103	TPS54110	PTHxx050W <sup>2</sup>
TMS320R2811 (1.9 V)	TPS79501	TPS70102	TPS40054	PT5103	TPS54110	PTHxx050W <sup>2</sup>
TMS320R2812 (1.9 V)	TPS79501	TPS70102	TPS40054	PT5103	TPS54110	PTHxx050W <sup>2</sup>

Supervised Voltage	1.8 V	3.3 V	5 V	Adj <sup>3</sup>
Dual SVS <sup>1</sup>	TPS3305-18	N/A	N/A	TPS3110
Supply Voltage Supervisor	TPS3808G18	TPS3808G33	TPS3808G50	TPS3808G01

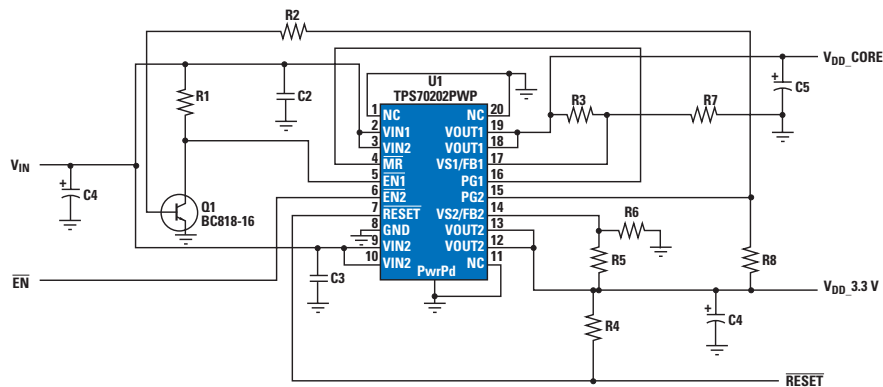
Note 1: Other supervised voltage is 3.3 V

Note 2: xx is determined by input bus voltage: V<sub>IN</sub> = 12 V then xx = 12, V<sub>IN</sub> = 5 V then xx = 05, and V<sub>IN</sub> = 3.3 V then xx = 03.

Note 3: Adjustable supply voltage supervisors are available for other core voltages.

Note 4: Visit [www.ti.com/dspower](http://www.ti.com/dspower) for one-stop DSP power management support.

### Example C2000 Controller Power Supply Design



For additional power supply designs for TI DSPs, please visit [www.ti.com/dspower](http://www.ti.com/dspower).

Note: The TI power devices recommended here are based on standard operating conditions. System designers should use device power estimation tools in conjunction with overall application level power requirements to ensure an adequate power supply design is used.



## Silicon

### TMS320C55x™ DSP Generation, Fixed Point

Industry's Best Power Efficiency

Get samples, datasheets, tools and app reports at: [www.ti.com/c5000](http://www.ti.com/c5000)

#### Specifications

- Broad portfolio of the industry's most power-efficient DSPs with standby power as low as 0.12 mW and performance up to 600 MIPs
- Lowest industry standby power greatly extends battery life
- Software compatible with all C5000™ DSPs
- Easy-to-use software and development tools speed time-to-market

#### Applications

Feature-rich, miniaturized personal and portable products; 2G, 2.5G and 3G cell phones and basestations; digital audio players; digital still cameras; electronic books, voice recognition, GPS receivers; fingerprint/pattern recognition; wireless modems; headsets; biometrics

#### Features

- Advanced automatic power management
- Configurable idle domains to extend your battery life
- Shortened debug for faster time-to-market
- Large on-chip RAM of 32 KB–320 KB

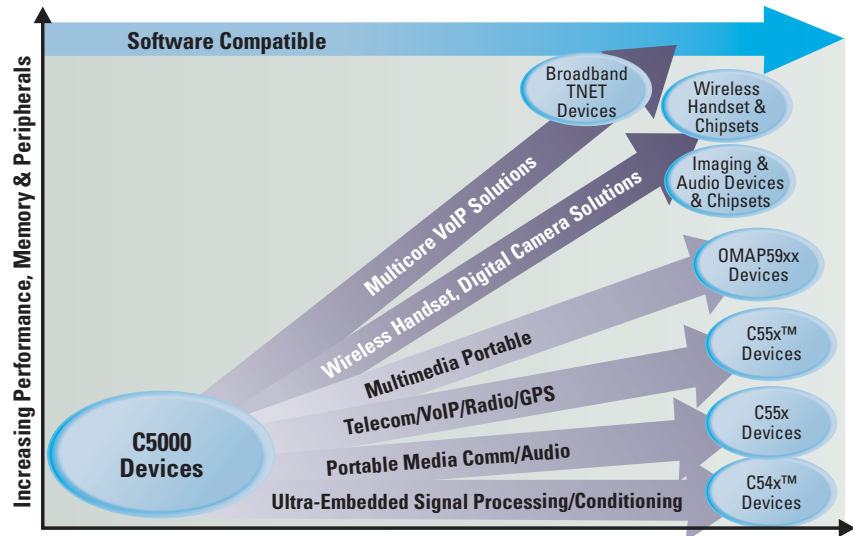
#### TMS3205509A DSP – Portable and Connected DSP Optimized for Portable/Industrial Medical Markets

- Dual MAC/200 MHz/400 MIPs
- USB 2.0 full-speed compliant (12 Mbps)
- Large on-chip SRAM
- 10-bit ADC, real-time clock (RTC), glue-less media interfaces to MMC and SD
- Very low standby power of 0.12 mW

#### TMS320C5501 / C5502 DSPs – Price and Performance Leaders

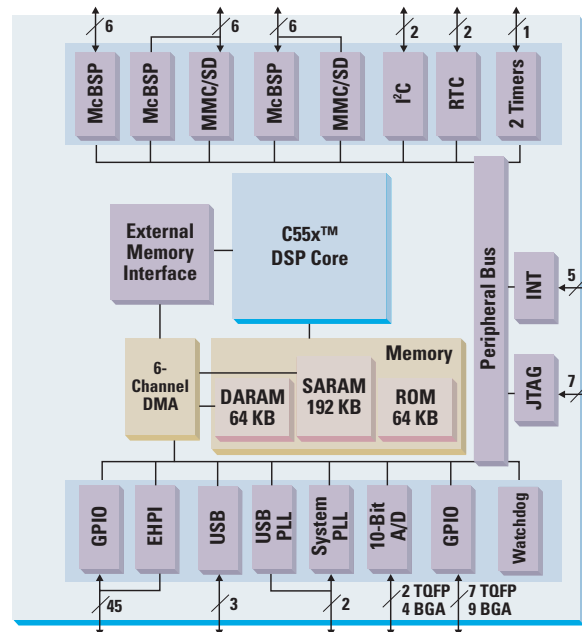
- 300-MHz clock rate
- 32-/64-KB RAM, 32-KB ROM
- Two/Three multi-channel buffered serial ports (McBSPs), I<sup>2</sup>C, general-purpose timers, watchdog timer, UART
- 16-/32-bit EMIF

#### TMS320C5510 DSP – Ideal for Memory-Intensive Applications



#### C5000 DSP Platform Roadmap

The C5000 DSPs span the applications spectrum with core performance extended to 300 MHz.



#### TMS320C5509A DSP Block Diagram

The C5509A DSP is the portable and connected DSP optimized for portable/industrial medical markets.



TMS320C55x™ DSP Generation

Part Number	RAM (Bytes)	ROM (Bytes)	DMA	DAT/PRO (ADDR) (Words)	USB	ADC	UART	I <sup>2</sup> C	RTC	McBSP <sup>1</sup>	MMC/SD	Voltage (V) Core	I/O	COM	Timers <sup>§</sup>	MHz	MIPS	Packaging	1 KU (U.S.) <sup>†</sup>
TMS320VC5501GZZ300 <sup>Ⓓ</sup>	32K	32K	6 ch	8M	-	-	Y	Y	-	2	-	1.26	3.3	HPI8	3*	300	600	201 BGA <sup>∘</sup>	4.99
TMS320VC5501PGF300 <sup>Ⓓ</sup>	32K	32K	6 ch	8M	-	-	Y	Y	-	2	-	1.26	3.3	HPI8	3*	300	600	176 LQFP	4.99
TMS320VC5502GZZ200 <sup>Ⓓ</sup>	64K	32K	6 ch	8M	-	-	Y	Y	-	3	-	1.26	3.3	HPI16/8	3*	200	400	201 BGA <sup>∘</sup>	7.51
TMS320VC5502PGF200 <sup>Ⓓ</sup>	64K	32K	6 ch	8M	-	-	Y	Y	-	3	-	1.26	3.3	HPI16/8	3*	200	400	176 LQFP	7.51
TMS320VC5502PGF300 <sup>Ⓓ</sup>	64K	32K	6 ch	8M	-	-	Y	Y	-	3	-	1.26	3.3	HPI16/8	3*	300	600	176 LQFP	9.66
TMS320VC5502GZZ300 <sup>Ⓓ</sup>	64K	32K	6 ch	8M	-	-	Y	Y	-	3	-	1.26	3.3	HPI16/8	3*	300	600	201 BGA <sup>∘</sup>	9.66
TMS320VC5503GHH	64K	64K	6 ch	8M	-	-	-	Y	Y	3	-	1.6	3.3	HPI16	2*	200	400	179 BGA <sup>∘</sup>	7.83
TMS320VC5503PGE	64K	64K	6 ch	8M	-	-	-	Y	Y	3	-	1.6	3.3	HPI16	2*	200	400	144 LQFP	7.83
TMS320VC5507GHH	128K	64K	6 ch	8M	Y	Y	-	Y	Y	3	-	1.6	3.3	HPI16	2*	200	400	179 BGA <sup>∘</sup>	11.29
TMS320VC5507PGE	128K	64K	6 ch	8M	Y	Y	-	Y	Y	3	-	1.6	3.3	HPI16	2*	200	400	144 LQFP	11.29
TMS320VC5509AGHH <sup>¶</sup>	256K	64K	6 ch	8M	Y	Y	-	Y	Y	3	Y	1.6	3.3	HPI16	2*	200	400	179 BGA <sup>∘</sup>	17.28
TMS320VC5509APGE <sup>¶</sup>	256K	64K	6 ch	8M	Y	Y	-	Y	Y	3	Y	1.6	3.3	HPI16	2*	200	400	144 LQFP	17.28
TMS320VC5510AGGW1	320K	32K	6 ch	8M	-	-	-	-	-	3	-	1.6	3.3	HPI16	2	160	320	240 BGA <sup>∘</sup>	17.34
TMS320VC5510AGGW2	320K	32K	6 ch	8M	-	-	-	-	-	3	-	1.6	3.3	HPI16	2	200	400	240 BGA <sup>∘</sup>	20.40

Note: All devices include software PLL.

<sup>1</sup> Multi-channel buffered serial port (McBSP).

<sup>∘</sup> MicroStar BGA™ package.

<sup>§</sup> 3 = Two general-purpose timers and one 32-bit DSP/BIOS™ kernel counter, 2 = Two general-purpose timers.

\* Plus 1 additional programmable watchdog timer.

<sup>Ⓓ</sup> Extended temperature device, -40 to 85°C case temperature operation.

<sup>¶</sup> JTAG disconnect option.

<sup>†</sup> Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order.

Note: Enhanced plastic and Military DSP versions are available for selected DSPs.



MicroStar BGA™ Package Comparison

The ultra-small physical size (12 mm × 12 mm × 1.4 mm) of the C5000™ DSP MicroStar BGA (ball grid array) packaging can also help increase the performance per square inch for MIPS-intensive or space-constrained applications. The C5509A DSP is also pictured in a 144-pin LQFP.



## Silicon

### TMS320C54x™ DSP Generation, Fixed Point

Power-Efficient Performance DSPs

Get samples, datasheets, tools and app reports at: [www.ti.com/c5000](http://www.ti.com/c5000)

#### Specifications

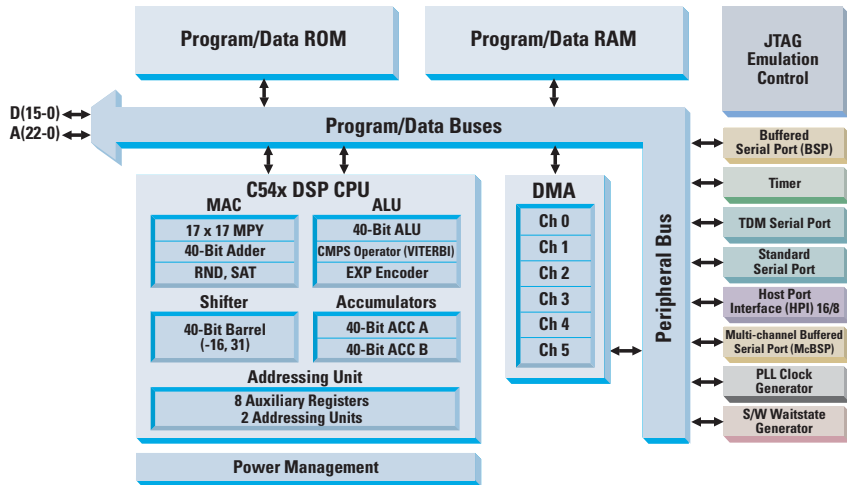
- 16-bit fixed-point DSPs
- Power dissipation as low as 40 mW
- Single- and multi-core products delivering 30–532 MIPS performance
- 1.2-, 1.8-, 2.5-, 3.3- and 5-V versions available
- Three power-down modes
- Integrated RAM and ROM configurations
- Auto-buffered serial port
- Multi-channel buffered serial port
- Host port interface
- Ultra-thin packaging (100-, 128-, 144- and 176-pin LQFPs; 143-, 144-, 176- and 169-pin MicroStar BGAs™)
- 6-channel DMA controller per core

#### Applications

Digital cellular communications, personal communications systems, pagers, personal digital assistants, digital cordless communications, wireless data communications, networking, computer telephony, voice over packet, portable Internet audio, modems

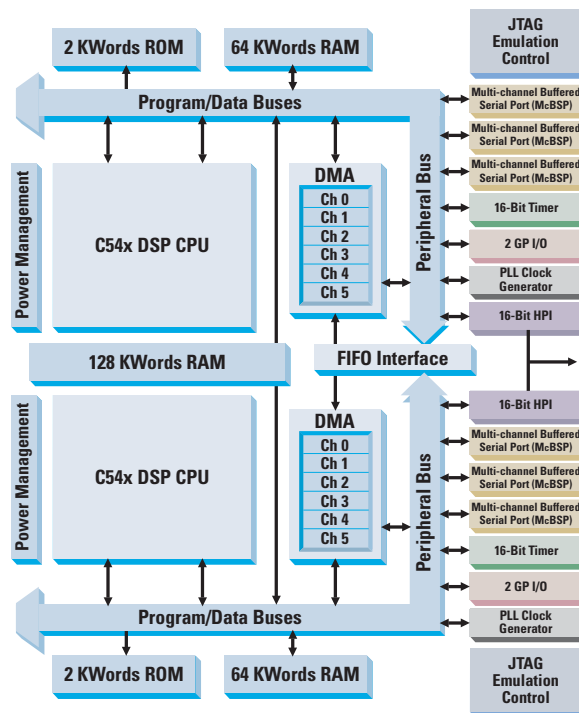
#### Features

- Integrated VITERBI accelerator
- 40-bit adder and two 40-bit accumulators to support parallel instructions
- 40-bit ALU with a dual 16-bit configuration capability for dual one-cycle operations
- $17 \times 17$  multiplier allowing 16-bit signed or unsigned multiplication
- Four internal buses and dual address generators enable multiple program and data fetches and reduce memory bottleneck
- Single-cycle normalization and exponential encoding
- Eight auxiliary registers and a software stack enable advanced fixed-point DSP C compiler
- Power-down modes for battery-powered applications



#### C54x™ DSP Generation Block Diagram

This block diagram of the C54x DSP is a comprehensive diagram showing all peripheral options. C54x DSPs are optimized to meet the performance, cost and low-power needs of wireless and wireline communications systems as well as emerging applications like IP phones, VoP and portable applications.



#### TMS320C5421 Multicore DSP Block Diagram

The C5420 and C5421 DSPs are dual-core DSPs targeted at carrier-class voice and video end equipments. The C5441 DSP features four C54x DSP cores on a single piece of silicon, offering 532 MIPS and is targeted at high-channel density solutions.



## TMS320C54x™ DSP Generation

Part Number	RAM	ROM	DAT/PRO	McBSP	Voltage (V)		COM	Timers	DMA	MHz	MIPS	Packaging	1 KU (\$U.S.)*
	(Bytes)	(Bytes)	(ADDR) (Bytes)		Core	I/O							
<b>Single Core DSPs</b>													
TMS320C54CSTPGE*	80K	256K	128K/16M	2	1.5	3.3	HPI 8/16	2	6	120	120	144 LQFP	7.89
TMS320C54CSTGGU*	80K	256K	128K/16M	2	1.5	3.3	HPI 8/16	2	6	120	120	144 BGA°	7.89
TMS320VC5401PGE50	16K	8K	128K/2M	2	1.8	3.3	HPI 8	2	6	50	50	144 LQFP	4.08
TMS320VC5401GGU50	16K	8K	128K/2M	2	1.8	3.3	HPI 8	2	6	50	50	144 BGA°	4.08
TMS320VC5402PGE100	32K	8K	128K/2M	2	1.8	3.3	HPI 8	2	6	100	100	144 LQFP	5.37
TMS320VC5402GGU100	32K	8K	128K/2M	2	1.8	3.3	HPI 8	2	6	100	100	144 BGA°	5.37
TMS320VC5402APGE16	32K	32K	128K/16M	3	1.6	3.3	HPI 8	1	6	160	160	144 LQFP	10.63
TMS320VC5402AGGU16	32K	32K	128K/16M	3	1.6	3.3	HPI 8	1	6	160	160	144 BGA°	10.63
TMS320VC5404PGE	32K	128K	128K/16M	3	1.5	3.3	HPI 8/16	2	6	120	120	144 LQFP	7.78
TMS320VC5404GGU	32K	128K	128K/16M	3	1.5	3.3	HPI 8/16	2	6	120	120	144 BGA°	7.78
TMS320UC5405GQW	16K	4K	64K/1M	2	1.8	3.6	HPI 8	2	6	80	80	143 BGA°	5.60
TMS320VC5407PGE	80K	256K	128K/16M	3	1.6	3.3	HPI 8/16	2	6	120	120	144 LQFP	9.39
TMS320VC5407GGU	80K	256K	128K/16M	3	1.6	3.3	HPI 8/16	2	6	120	120	144 BGA°	9.39
TMS320VC5409PGE-80	64K	32K	128K/16M	3	1.8	3.3	HPI 8/16	1	6	80	80	144 LQFP	8.32
TMS320VC5409GGU-80	64K	32K	128K/16M	3	1.8	3.3	HPI 8/16	1	6	80	80	144 BGA°	8.32
TMS320VC5409PGE100	64K	32K	128K/16M	3	1.8	3.3	HPI 8/16	1	6	100	100	144 LQFP	10.22
TMS320VC5409GGU100	64K	32K	128K/16M	3	1.8	3.3	HPI 8/16	1	6	100	100	144 BGA°	10.22
TMS320VC5409APGE12	64K	32K	128K/16M	3	1.5	3.3	HPI 8/16	1	6	120	120	144 LQFP	10.89
TMS320VC5409AGGU12	64K	32K	128K/16M	3	1.5	3.3	HPI 8/16	1	6	120	120	144 BGA°	10.89
TMS320VC5409APGE16	64K	32K	128K/16M	3	1.6	3.3	HPI 8/16	1	6	160	160	144 LQFP	13.37
TMS320VC5409AGGU16	64K	32K	128K/16M	3	1.6	3.3	HPI 8/16	1	6	160	160	144 BGA°	13.37
TMS320VC5410PGE100	128K	32K	128K/16M	3	2.5	3.3	HPI 8	1	6	100	100	144 LQFP	28.83
TMS320VC5410GGU100	128K	32K	128K/16M	3	2.5	3.3	HPI 8	1	6	100	100	176 BGA°	28.83
TMS320VC5410APGE12	128K	32K	128K/16M	3	1.5	3.3	HPI 8/16	1	6	120	120	144 LQFP	14.49
TMS320VC5410AGGU12	128K	32K	128K/16M	3	1.5	3.3	HPI 8/16	1	6	120	120	144 BGA°	14.49
TMS320VC5410APGE16	128K	32K	128K/16M	3	1.6	3.3	HPI 8/16	1	6	160	160	144 LQFP	16.05
TMS320VC5410AGGU16	128K	32K	128K/16M	3	1.6	3.3	HPI 8/16	1	6	160	160	144 BGA°	16.05
TMS320VC5416PGE120	256K	32K	128K/16M	3	1.5	3.3	HPI 8/16	1	6	120	120	144 LQFP	24.15
TMS320VC5416GGU120	256K	32K	128K/16M	3	1.5	3.3	HPI 8/16	1	6	120	120	144 BGA°	24.15
TMS320VC5416PGE160	256K	32K	128K/16M	3	1.6	3.3	HPI 8/16	1	6	160	160	144 LQFP	26.84
TMS320VC5416GGU160	256K	32K	128K/16M	3	1.6	3.3	HPI 8/16	1	6	160	160	144 BGA°	26.84
<b>Multicore DSPs</b>													
TMS320VC5420PGE200 <sup>†</sup>	400K	–	128K/512K	6	1.8	3.3	HPI 16	2	12	2 × 100	200	144 LQFP	59.25
TMS320VC5420GGU200 <sup>†</sup>	400K	–	128K/512K	6	1.8	3.3	HPI 16	2	12	2 × 100	200	144 BGA	59.25
TMS320VC5421PGE200 <sup>†</sup>	512K	8K	128K/512K	6	1.8	3.3	HPI 16	2	12	2 × 100	200	144 LQFP	60.70
TMS320VC5421GGU200 <sup>†</sup>	512K	8K	128K/512K	6	1.8	3.3	HPI 16	2	12	2 × 100	200	144 BGA	60.70

° MicroStar BGA™ package.

† Multicore devices (VC542x = 2).

\* Client side telephony (CST) software bundle information on page 11.

<sup>‡</sup> Internal bootloader not available on VC5420 DSP.

Note: All devices include software PLL.

Note: Enhanced plastic and Military DSP versions are available for selected DSPs.

\* Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order.



## Silicon

### OMAP™ Processors, Fixed Point

System-Level DSPs

Get samples, datasheets, tools and app reports at: [www.omap.com](http://www.omap.com)

#### Applications

##### Portable Data Terminals (PDT)

- Portable medical devices
  - Portable defibrillation
  - Home medical test and analysis
  - PDT for patient/medical personal
- Asset and inventory management
  - Parcel tracking and location
  - Stock inventory and replenishment
  - Real-time data capture, analysis and interpretation
- Point of sale
  - Sales and membership processing
  - Merchandising and pricing management
  - Verification and authentication
- Enterprise PDT
  - Commercial and business applications
  - Enhanced employee productivity

#### Key Features

- Extensive peripheral set supporting glueless interface to multiple radio technologies (GSM/GPRS, WLAN, BT, RF)
- Industry-leading C55x™ DSP core offering portable data terminal-centric algorithms via TI DSP Third Party Network
- Multibus architecture for PDT system-level optimization
- On-chip frame buffer supporting multiple display variations
- Hardware encryption engine enabling industry-standard security applications
- Robust man/machine interface ARM9 core for multiple operating systems and application programs

#### OMAP59xx Processors Support

- Microsoft® Windows® CE
- Linux®
- Accelerated Technologies Nucleus™
- WindRiver Systems VxWorks™
- Texas Instruments DSP/BIOS™ kernel
- And many more

## Embedded OMAP Processors: OMAP5910 and OMAP5912

### Addressing the Needs of Next-Generation Embedded Designers for Portable Data Terminal Applications

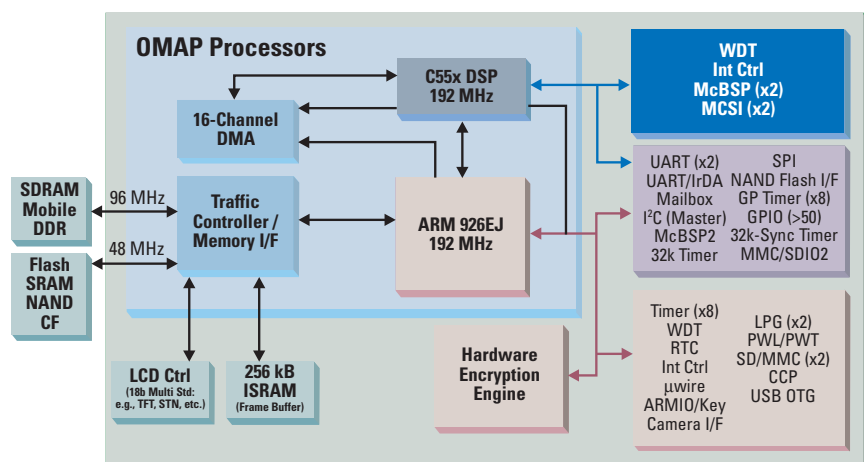
The dual-core OMAP59xx processor integrates a TMS320C55x™ DSP core with an ARM9 core on a single chip for the optimal combination of application performance and low power consumption. This unique architecture offers an attractive solution to both DSP and ARM developers, by providing the low-power, real-time signal processing capabilities of a DSP coupled with the command and control functionality of an ARM.

TI's software development support, OMAP Technology Centers (OTCs), OMAP Developer's Network, and third party tools provide a user-friendly software development infrastructure. The OMAP59xx processors are ideal for designers working with devices that require embedded applications processing in a connected environment such as portable data terminals.

### Familiar Development Environment Speeds Design Cycle

The OMAP59xx processor enables embedded developers to program using familiar development environments by supporting leading operating systems such as Microsoft Windows CE, Linux, Accelerated Technology's Nucleus, WindRiver's VxWorks, Green Hills INTEGRITY®, Enea OSE and TI's DSP/BIOS real-time scalable kernel among others.

This open development environment makes it possible for designers to deliver innovative products to the market faster, utilizing familiar tools, a standard application programming interface (API) and a seamless interface to the DSP through an optimized interprocessor communication mechanism. The built-in interprocessor communication mechanism eliminates the need for developers to program the RISC and DSP independently resulting in reduced programming efforts.



### OMAP5912 Peripheral Block Diagram

OMAP5912 processor diagram with ARM926 and C55x DSP cores and peripherals.



OMAP™ Processors

Part Number	CPU	Frequency (MHz)	RAM (Bytes)	ROM (Bytes)	External Memory I/F	DMA	Timers	Serial Ports	Misc	Voltage (V)		Packaging	1 KU (\$U.S.) <sup>†</sup>
										Core	I/O		
OMAP5910JGZG2	C55x	150	160K	32K	SDRAM*, ASYNC*	6 Ch	3 GP, 1 WDT	2 McBSP*, 2 MCSI*	3 Video HW Accel, 14 GPIO*, MMU	1.6	1.8/2.75/3.3 <sup>§</sup>	289 BGA <sup>°</sup> , 12 × 12 mm	24.47
	ARM9TDMI	150	192K <sup>†</sup>		SDRAM, ASYNC	9 Ch	1 OS, 3 GP, 1 WDT	3 Host or 2 Host/1 Function USB 1.1, 1 McBSP, $\mu$ wire, I <sup>2</sup> C, HDQ, 3 UARTs (1 IrDA) <sup>†</sup>	LCD, Camera, MMC/SD, RTC, Keypad, 10 GPIO, MMU				
OMAP5910JGDY2	C55x	150	160K	32K	SDRAM*, ASYNC*	6 Ch	3 GP, 1 WDT	2 McBSP*, 2 MCSI*	3 Video HW Accel, 14 GPIO*, MMU	1.6	1.8/2.75/3.3 <sup>§</sup>	289 BGA <sup>°</sup> , 19 × 19 mm	25.40
	ARM9TDMI	150	192K <sup>†</sup>		SDRAM, ASYNC	9 Ch	1 OS, 3 GP, 1 WDT	3 Host or 2 Host/1 Function USB 1.1, 1 McBSP, $\mu$ wire, I <sup>2</sup> C, HDQ, 3 UARTs (1 IrDA) <sup>†</sup>	LCD, Camera, MMC/SD, RTC, Keypad, 10 GPIO, MMU				
OMAP5912ZZG	C55x	192	160K	32K	SDRAM*, NAND Flash*	6 Ch	4 GP, 1 WDT	2 McBSP*, 2 MCSI*, 3 UARTs*	4 Video HW Accel, 24 KByte I-Cache	1.6	1.8/2.75/3.3 <sup>§</sup>	289 BGA, 12 × 12 mm	28.58
	ARM926EJ-S	192	256K <sup>†</sup>		SDRAM, ASYNC	17 Ch	1 OS, 3 GP, 1 WDT	Host/Function USB 1.1, USB On-the-Go (OTG), 1 McBSP, $\mu$ wire, I <sup>2</sup> C, HDQ, SPI, V-Link	Self-Powered RTC, LCD, CompactFlash, Camera, 2 MMC/SD, Keyboard, DPLL, PWT/PWL, 2 LED Pulse Generators, SoSSI			Lead free	
OMAP5912ZDY	C55x	192	160K	32K	SDRAM*, NAND Flash*	6 Ch	4 GP, 1 WDT	2 McBSP*, 2 MCSI*, 3 UARTs*	4 Video HW Accel, 24 KByte I-Cache	1.6	1.8/2.75/3.3 <sup>§</sup>	289 BGA, 19 × 19 mm	28.58
	ARM926EJ-S	192	256K <sup>†</sup>		SDRAM, ASYNC	17 Ch	1 OS, 3 GP, 1 WDT	Host/Function USB 1.1, USB-On-the-Go (OTG), 1 McBSP, $\mu$ wire, I <sup>2</sup> C, HDQ, SPI, V-Link	Self-Powered RTC, LCD, CompactFlash, Camera, 2 MMC/SD, Keyboard, DPLL, PWT/PWL, 2 LED Pulse Generators, SoSSI			Lead free	

\* Shared with the ARM9.

<sup>†</sup> Shared with the C55x™ CPU.

<sup>§</sup> External memory interfaces may use 1.8-, 2.75- or 3.3-V nominal.

<sup>°</sup> MicroStar BGA™ package options – GZG: 12 × 12 mm (OMAP5910JGZG2) or GDY: 19 × 19 mm (OMAP5910JGDY2)

Note: Enhanced plastic and Military DSP versions are available for selected DSPs.

<sup>†</sup> Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order.

# Lead (Pb)-Free Solutions from Texas Instruments

TI is a leader in the supply of Lead (Pb)-Free integrated circuit packages. Currently more than 30 billion TI Pb-Free components are in the field with many new Pb-Free devices being added every year.



For all your Lead (Pb)-Free questions, visit [www.ti.com/quality](http://www.ti.com/quality)

Examples of Pb-Free package types available or planned for select devices by end of 2004:

- LQFP
- MicroStar BGA™
- MicroStar Junior™
- MSOP
- NanoFree™
- PBGA
- PDIP
- PLCC
- PowerPAD™
- QFN
- QFP
- QSOP
- SC70
- SIP
- SOIC
- SOP
- SOT223
- SOT23
- SSOP
- TO-220
- TQFP
- TSOT
- TSSOP
- TVSOP





## OMAP™ Tools, Software and Support

### OMAP Platform Tools and Software

To aid you in developing your application with an OMAP59xx processor, the following development tools and software are available:

- Code Composer Studio™ IDE for the OMAP platform integrates all host and target tools in a unified environment, which simplifies DSP configuration and optimization.
- A growing base of TI DSP-based software modules from third parties including over 70 eXpressDSP™-compliant, interoperable algorithms.

### Support

OMAP Technology Centers (OTCs) are a network of third parties with extensive development experience on the OMAP platform. They have system-level expertise in operating systems, software development and hardware integration. OTCs work with customers to develop a custom integration package. Additionally, the OMAP Developer's Network includes a number of independent companies and consultants that develop applications for the OMAP platform.

### Samples and Availability

The OMAP5910 processor is in volume production and the OMAP5912 is sampling. Please contact an authorized TI distributor for further information.

## OMAP59xx Processors Literature and Related Technical Documentation

Data Sheets	Web Search Literature #
OMAP5912 Processor Data Manual	SPRS231
OMAP5912 Processor Silicon Errata	SPRZ209
OMAP5910 Processor Data Manual	SPRS197
OMAP5910 Processor Silicon Errata	SPRZ016
Hardware User's Guides	
OMAP5910 Technical Reference	SPRU602
OMAP5912 Multimedia Processor Device Overview and Architecture Reference Guide	SPRU748
OMAP5912 Multimedia Processor OMAP 3.2 Subsystem Reference Guide	SPRU749
OMAP5912 Multimedia Processor DSP Subsystem Reference Guide	SPRU750
OMAP5912 Multimedia Processor Clocks Reference Guide	SPRU751
OMAP5912 Multimedia Processor Initialization Reference Guide	SPRU752
OMAP5912 Multimedia Processor Power Management Reference Guide	SPRU753
OMAP5912 Multimedia Processor Security Features Reference Guide	SPRU754
OMAP5912 Multimedia Processor Direct Memory Access (DMA) Support Reference Guide	SPRU755
OMAP5912 Multimedia Processor Memory Interfaces Reference Guide	SPRU756
OMAP5912 Multimedia Processor Interrupts Reference Guide	SPRU757
OMAP5912 Multimedia Processor Peripheral Interconnects Ref. Guide	SPRU758
OMAP5912 Multimedia Processor Timers Reference Guide	SPRU759
OMAP5912 Multimedia Processor Serial Interfaces Reference Guide	SPRU760
OMAP5912 Multimedia Processor Universal Serial Bus (USB) Ref. Guide	SPRU761
OMAP5912 Multimedia Processor Multi-channel Buffered Serial Ports (McBSPs) Reference Guide	SPRU762
OMAP5912 Multimedia Processor Camera Interface Reference Guide	SPRU763

Hardware User's Guides (Cont'd)	Web Search Literature #
OMAP5912 Multimedia Processor Display Interface Reference Guide	SPRU764
OMAP5912 Multimedia Processor Multimedia Card (MMC/SD/SDIO) Interface Reference Guide	SPRU765
OMAP5912 Multimedia Processor Keyboard Interface Reference Guide	SPRU766
OMAP5912 Multimedia Processor General-Purpose Interface Ref. Guide	SPRU767
OMAP5912 Multimedia Processor VLYNQ Serial Communications Interface Reference Guide	SPRU768
OMAP5912 Multimedia Processor Pinout Reference Guide	SPRU769
Application Notes	
System Initialization for the OMAP5910 Device	SPRA828
OMAP5910 ARM Program Throughput Analysis	SPRA891
OMAP System DMA Throughput Analysis	SPRA883
An RF6 JPEG Decoder Adaptation on the OMAP5910 Processor	SPRA979
Connecting TFT LCD Displays to the OMAP5910 Processor	SPRA968
OMAP5910 Processor Low-Power System Design	SPRA954
Connecting Bluetooth® to the OMAP5910 Processor	SPRA986
OMAP5910 Processor Video Encoding and Decoding	SPRA985
Connecting an 802.11b WLAN Card to the OMAP5910 Processor	SPRA984
OMAP5910 Processor Audio System Design	SPRA970
OMAP5910 Processor Decoupling/Filtering Techniques	SPRA906
OMAP5910 Processor NTSC or VGA Output	SPRA847
White Papers	
Multimedia Technologies on Terminals Based on OMAP Platform	SWPY006
Enabling the Killer Application	SWPY004
Bringing Streaming Video to Wireless Handheld Devices	SWPY005

Check the TI website for a complete listing of technical documentation including application notes.

## OMAP59xx Processor On-Line Training

For more information on OMAP on-line training classes, go to: [www.ti.com/omaptraining](http://www.ti.com/omaptraining)

OMAP5910 Processor Product Overview	<a href="http://www.ti.com/omap5910">www.ti.com/omap5910</a>
OMAP Application Development Using DSP/BIOS™ Bridge for Symbian OS	<a href="http://www.ti.com/omapsymbian">www.ti.com/omapsymbian</a>
An Efficient Hardware and Software Architecture for Dual-Core OMAP Processor Systems	<a href="http://www.ti.com/omap5910">www.ti.com/omap5910</a>
Software Development for OMAP Processors: High-Level Operating Systems and Integration of DSP Algorithms	<a href="http://www.ti.com/omapdevelopers">www.ti.com/omapdevelopers</a>



### C5000™ DSP Platform Hardware and Software Development Tools

Description	Part #	U.S.+
<b>C5000 DSP and OMAP Processor Starter Kits (DSKs)</b>		
TMS320C54x™ DSP Starter Kit (DSK), TMS320C5416 DSP based*	TMDSOSK5416 (U.S. part number) TMDSOSK5416-0E (European part number)	395
TMS320C55x™ DSP Starter Kit (DSK), TMS320C5510 DSP based*	TMDSOSK5510 (U.S. part number) TMDSOSK5510-0E (European part number)	395
Fingerprint Authentication Development Tool	TMDSDFCFPC10	245
OMAP5912 OMAP™ Starter Kit (OSK) <sup>§</sup>	TMDSOSK5912 (U.S. part number) TMDSOSK5912-0E (European part number)	295
<b>OMAP Development Kits</b>		
OMAP Starter Kit (OSK) Bundle <sup>†</sup> with a Logic PD Kickstart Program	TMDSKSP5912-L (U.S. part number) TMDSKSP5912-LE (European part number)	7,200
OMAP Starter Kit (OSK) Bundle <sup>†</sup> with a Mistral Kickstart Program	TMDSKSP5912-M (U.S. part number) TMDSKSP5912-ME (European part number)	7,200
<b>JTAG Emulators</b>		
XDS560™ PCI-Based High-Performance JTAG Emulator	TMDSEMU560	3,995
XDS560 Blackhawk USB High-Performance JTAG Emulator	TMDSEMU560U (U.S. part number) TMDSEMU560U-0E (European part number)	2,995
XDS510PP-Plus – Parallel Port Emulator for Windows	TMDSEMUPP (U.S. part number) TMDSEMUPP-0E (European part number)	1,500
XDS510™ USB-Based Emulator for Windows	TMDSEMUUSB	1,995
<b>Software Development Tools</b>		
Code Composer Studio Platinum Edition Development Tools Bundled with Annual Software Subscription Supports C6000™ DSP, C5000 DSP, C2000™ DSP and OMAP™ processor platforms	TMDSOCCSALL-1	3,595
C5000 DSP Code Composer Studio Development Tools Annual Software Subscription for Version 2.x	TMDSOCCS5000	600
Code Composer Studio Development Tools for OMAP Platform Annual Software Subscription for Version 2.x	TMDSOCCSBOMAP	900
Essential Guide to Getting Started with DSP CD-ROM Includes C5000 DSP Code Composer Studio 120-Day Free Evaluation Tools <sup>‡</sup>	SPRC119C <a href="http://www.ti.com/freetools">www.ti.com/freetools</a>	Free
C54x DSP Software Library	SPRC099	Free
C55x DSP Software Library	SPRC100	Free
C55x DSP Imaging Software Library	SPRC101	Free
C54x DSP Chip Support Library	SPRC132	Free
C55x DSP Chip Support Library	SPRC133	Free

\* Includes a DSK version of Code Composer Studio™ Development Tools restricted for use only with the DSP target board included in the kit, power supply and cables.

Please see the features supported by platform matrix on page 61 for more details.

New tools are listed in red.

<sup>†</sup> Includes Code Composer Studio Development Tools, DSP/BIOS™ kernel, code generation tools (C/C++/assembler/linker), XDS510™ and XDS560™ device drivers (emulation software), RTDX™, and simulators. Please see the features supported by platform matrix on page 61 for more details.

<sup>‡</sup> Includes full-featured Code Composer Studio Development Tools, code generation tools (C/C++ compiler/assembler/linker), emulator and simulator configurations all limited to 120 days.

<sup>§</sup> OSK includes board with OMAP5912 processor, board support library, Linux® kernel and GNU development tools from MontaVista. CCStudio and emulator are sold separately.

<sup>+</sup> Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order.

### C5000 DSP Platform Tools and Software Documentation

Software Reference Guides	Web Search Literature #	Software Reference Guides (Cont'd)	Web Search Literature #
TMS320C55x DSP Programmer's Guide	SPRU376	TMS320C54x DSP Assembly Language Tools User's Guide	SPRU102
TMS320C55x DSP Optimizing C/C++ Compiler User's Guide	SPRU281	TMS320C54x DSP Library Programmer's Reference	SPRU518
TMS320C55x DSP Assembly Language Tools User's Guide	SPRU280	TMS320C55x DSP Library Programmer's Reference	SPRU422
TMS320C54x DSP Instruction Set Simulator Technical Overview	SPRU598	OMAP Instruction Set Simulator Technical Overview	SPRU601
TMS320C54x DSP Optimizing C/C++ Compiler User's Guide	SPRU103	TMS320C55x DSP Instruction Set Simulator Technical Overview	SPRU599
Code Composer Studio Getting Started Guide	SPRU509	TMS320C54x DSP Chip Support Library API User's Guide	SPRU420
TMS320™ DSP/BIOS™ User's Guide	SPRU423	TMS320C55x DSP Chip Support Library API User's Guide	SPRU433
TMS320C5000 DSP/BIOS Application Programming Interface (API) Reference Guide	SPRU404	TMS320C55x DSP CSL USB Programmer's Reference	SPRU511
TMS320C55x DSP Image/Video Processing Library Programmer's Ref.	SPRU037	<b>Product Bulletin</b>	
		XDS560 Emulator Product Bulletin	SPRB148

Check the TI website for a complete listing of technical documentation including application notes.



## Tools, Software and Support

### C5000™ DSP and TMS320™ DSP Algorithm Standard Literature and Related Technical Documentation

Data Sheets	Web Search Literature #
TMS320VC5401 DSP Data Sheet	SPRS153
TMS320VC5402 DSP Data Sheet	SPRS079
TMS320UC5405 DSP Data Sheet	SPRS199
TMS320VC5404/VC5407 DSP Data Sheet	SPRS007
TMS320VC5409 DSP Data Sheet	SPRS082
TMS320VC5409A DSP Data Sheet	SPRS140
TMS320VC5410 DSP Data Sheet	SPRS075
TMS320VC5410A DSP Data Sheet	SPRS139
TMS320VC5416 DSP Data Sheet	SPRS095
TMS320VC5420 DSP Data Sheet	SPRS080
TMS320VC5421 DSP Data Sheet	SPRS098
TMS320C54CST DSP Data Sheet	SPRS187
TMS320VC5502 DSP Data Sheet	SPRS166
TMS320VC5509 DSP Data Sheet	SPRS163
TMS320VC5509A DSP Data Sheet	SPRS205
TMS320VC5510 DSP Data Sheet	SPRS076
Technical Briefs and Overviews	
TMS320C55x™ DSP Technical Overview	SPRU393
TMS320C55x DSP Functional Overview	SPRU312
Hardware User's Guides	
TMS320C54x™ DSP CPU & Peripherals, Volume 1	SPRU131
TMS320C54x DSP Mnemonic Instruction Set, Volume 2	SPRU172
TMS320C54x DSP Algebraic Instruction Set, Volume 3	SPRU179
TMS320C54x DSP Enhanced Peripherals Guide, Volume 5	SPRU302
TMS320C55x DSP CPU Reference Guide	SPRU371
TMS320C55x DSP Algebraic Instruction Set Reference Guide	SPRU375

Hardware User's Guides (Cont'd)	Web Search Literature #
TMS320C55x DSP Mnemonic Instruction Set Reference Guide	SPRU374
TMS320C55x DSP Peripherals Reference Guide	SPRU317
Software User's and Reference Guides	
TMS320C54x DSP Application Guide, Volume 4	SPRU173
TMS320C55x DSP Library (DSPLIB) Programmer's Reference	SPRU422
TMS320C54x-to-TMS320C55x DSP Code Migration Reference Guide	SPRU429
TMS320C55x DSP Image/Video Processing Library Programmer's Reference	SPRU037
TMS320C54x DSP Library Programmer's Reference	SPRU518
TMS320 DSP Algorithm Standard Rules and Guidelines	SPRU352
TMS320 DSP Algorithm Standard API Reference	SPRU360
TMS320 DSP Algorithm Standard Demonstration Application	SPRU361
TMS320 DSP Algorithm Standard Developer's Guide	SPRU424
Product Bulletins	
Client-Side Telephony Solution Product Bulletin	SPRT228
Application Notes	
System Initialization for the OMAP5910 Device	SPRA828
A Case Study in DSP Systems Integration – The TI 3rd Party Vocoder Demonstration	SPRA734
Making DSP Algorithms Compliant with the TMS320 DSP Algorithm Standard	SPRA579
The TMS320 DSP Algorithm Standard White Paper	SPRA581
Using the TMS320 DSP Algorithm Standard in a Dynamic DSP System	SPRA580
Using the TMS320 DSP Algorithm Standard in a Static DSP System	SPRA577
White Paper	
The Future of DSP	SPRY049

Check the TI website for a complete listing of technical documentation including application notes.

### C5000 DSP Platform Support

C5000 DSP Application Notes	<a href="http://www.ti.com/c5000appnotes">www.ti.com/c5000appnotes</a>
C5000 DSP Benchmarks	<a href="http://www.ti.com/c5000bench">www.ti.com/c5000bench</a>
C5000 DSP Foundation Software	<a href="http://www.ti.com/c5000dsplib">www.ti.com/c5000dsplib</a>



Power Management Products for the C5000™ DSP Platform

Get samples, datasheets, Evaluation Modules (EVMs) and app reports at: [power.ti.com](http://power.ti.com)

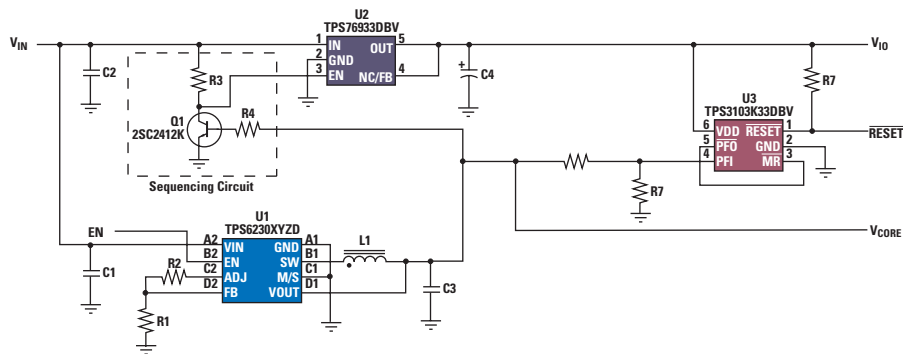
Suggested Texas Instruments Power Management Solutions for the TMS320C55x™ DSP Generation					
DSP Part Number	LDO	LDO	Buck Converter	SEPIC	Boost Converter
3.3-V I/O (Core)	(Core Only)	(I/O Only)	(Core Only)	Converter	(3.3 V) <sup>1</sup>
TMS320VC5501-200 (1.26 V)	TPS726126	TPS76633	TPS62050	TPS61130	TPS61031
TMS320VC5501-300 (1.26 V)	TPS726126	TPS76633	TPS62050	TPS61130	TPS61031
TMS320VC5502-200 (1.26 V)	TPS726126	TPS76633	TPS62050	TPS61130	TPS61031
TMS320VC5502-300 (1.26 V)	TPS726126	TPS76633	TPS62050	TPS61130	TPS61031
TMS320VC5503-200 (1.6 V)	TPS79401	TPS76633	TPS62204	TPS61130	TPS61031
TMS320VC5507-200 (1.6V)	TPS79401	TPS76633	TPS62204	TPS61130	TPS61031
TMS320VC5509A-200 (1.6 V)	TPS79401	TPS76633	TPS62204	TPS61130	TPS61031
TMS320VC5510-160 (1.6 V)	TPS79401	TPS76633	TPS62050	TPS61130	TPS61031
TMS320VC5510-200 (1.6 V)	TPS79401	TPS76633	TPS62050	TPS61130	TPS61031

Supervised Voltage	1.2 V	1.5 V	1.6 V	1.8 V	2.5 V	3.3 V
Dual SVS <sup>2</sup>	TPS3110K33	TPS3110K33	TPS3110K33	TPS3110K33	TPS3110K33	N/A
Supply Voltage Supervisor	TPS3808G12	TPS3808G15	TPS3808G01	TPS3808G18	TPS3808G25	TPS3808G33

Suggested Texas Instruments Power Management Solutions for the OMAP59xx Processors			
OMAP™ Part Number	Power Device	Description	Application Note
OMAP5910	TPS65010	Power and Battery Management Device	SPRA954A
OMAP5912	TPS65010	Power and Battery Management Device	SPRA954A

Note 1: Converter listed can supply 3.3 V for additional circuitry, as well as  $V_{core}$  and  $V_{I/O}$ .  
 Note 2: Other supervised voltage is 3.3 V.

Example C5000 DSP Power Supply Design



For additional power supply designs for TI DSPs, please visit [www.ti.com/dsppower](http://www.ti.com/dsppower).

Note: The TI power devices recommended here are based on standard operating conditions. System designers should use device power estimation tools in conjunction with overall application level power requirements to ensure an adequate power supply design is used.



## Silicon

### TMS320C64x™ DSP Generation, Fixed Point

Highest-Performance and Performance Value DSPs

Get samples, datasheets, tools and app reports at: [www.ti.com/c6000](http://www.ti.com/c6000)

#### Specifications

- Broadest portfolio of high performance DSPs ranging from \$20 to 1 GHz
- Shipping the industry's first 1-GHz DSPs on a 90-nm process node
- Upward 100% object code compatibility within C6000™ DSP platform
- The easiest to use integrated development environment with the industry's best optimizing C compiler

#### Applications

Wireless Infrastructure (adaptive antennas, basestations, gateways), Telecom Infrastructure (RAS, PBX, VoIP), Digital Video (conferencing, surveillance, statistical remultiplexor/broadband routers), Imaging (medical, machine vision/inspection, defense/radar/sonar)

#### Products

*Performance Value DSPs:*

**TMS320C6410/C6413 DSPs** – Low-cost for C64x™ DSP performance with up to 256-KBytes L2 memory

**TMS320C6412 DSP** – Low system cost through peripheral integration

- 32-bit PCI or 10-/100-Mb Ethernet MAC
- 256-KBytes L2 memory

*Highest-Performance DSPs:*

**TMS320C6414T DSP** – Setting the industry's performance standard

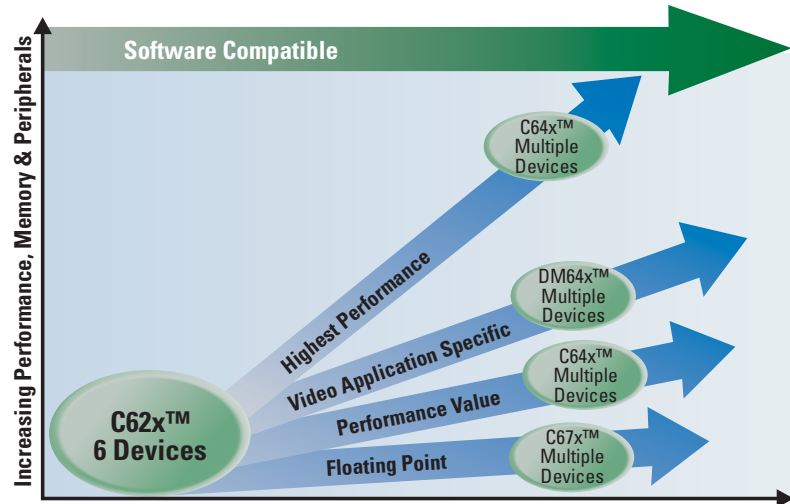
- Three multi-channel buffered serial ports (McBSPs)
- 32-bit host port interface (HPI)

**TMS320C6415T DSP** – Adds industry standard interfaces for multimedia and media gateway systems

- 32-bit/33-MHz PCI or 32-bit HPI
- Optional universal test and operations PHY interface for ATM (UTOPIA)

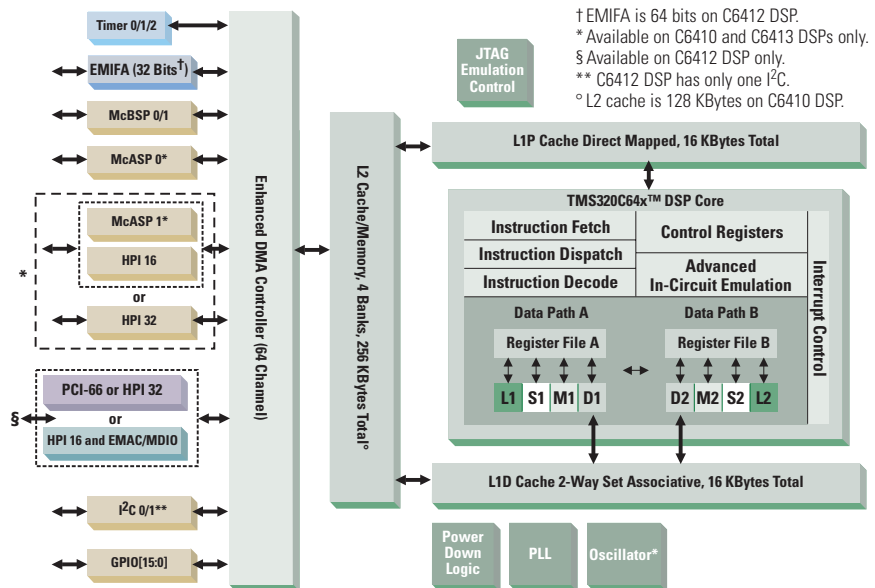
**TMS320C6416T DSP** – Features VITERBI decoder co-processor (VCP) and Turbo decoder co-processor (TCP)

**TMS320C6418 DSP** – Includes VCP and 512-KBytes L2 memory for communications applications



#### C6000™ DSP Platform Roadmap

The C6000 DSP platform includes a wide range of devices that raise the bar in performance, set new levels of cost efficiency and offer on-chip peripheral integration to enable developers of high-performance systems to choose the device that best suits their specific application.



#### TMS320C6410 / C6412 / C6413 DSP Block Diagram

*Performance Value* refers to lower price devices such as the C6410 and C6413 DSPs that provide a lower entry price point for high-performance DSPs. Through its low system cost due to aggressive peripheral integration, the C6412 DSP also offers performance value. The C64x DSP generation's Performance Value vector complements the existing high-performance leadership TI has maintained for years with the C6000 DSP platform.



**TMS320C64x™ DSP Generation – Performance Value Fixed-Point DSPs**

Part Number	Internal RAM (Bytes)		McBSP	Enhanced DMA (Channels)	COM°	Timers	MHz	MIPS	Power (W)*		Voltage (V)		Packaging	1 KU (\$U.S.)†
	L1 Program Cache/ L1 Data Cache/ L2 Unified RAM/Cache								CPU and L1	Total	Core	I/O		
<b>Performance Value</b>														
TMS320C6410GTS400	16K/16K/128K		2	64	HPI 32/16	3	400	3200	0.4	1.0	1.2	3.3	288 BGA, 23 mm	20.28
TMS320C6413GTS500	16K/16K/256K		2	64	HPI 32/16	3	500	4000	0.4	1.0	1.2	3.3	288 BGA, 23 mm	32.71
TMS320C6412GDK500	16K/16K/256K		2	64	PCI/HPI/EMAC†	3	500	4000	0.4	1.0	1.2	3.3	548 BGA, 23 mm	42.89
TMS320C6412GNZ500	16K/16K/256K		2	64	PCI/HPI/EMAC†	3	500	4000	0.4	1.0	1.2	3.3	548 BGA, 27 mm	42.89
TMS320C6412GDK600	16K/16K/256K		2	64	PCI/HPI/EMAC†	3	600	4800	0.6	1.5	1.4	3.3	548 BGA, 23 mm	48.25
TMS320C6412GNZ600	16K/16K/256K		2	64	PCI/HPI/EMAC†	3	600	4800	0.6	1.5	1.4	3.3	548 BGA, 27 mm	48.25

° HPI is selectable, 32-bit or 16-bit.

† The C6412 can be configured to have either a 32-bit PCI or 32-bit HPI, or a 16-bit HPI with Ethernet MAC.

\* Assumes 60% CPU utilization, 50% EMIF utilization (133 MHz for 1.4 V, 100 MHz for 1.2 V), 50% writes, 64-bits, 50% bit switching, 2 2-MHz McBSP at 100% utilization, and 2 75-MHz timers at 100% utilization. See SPRA811.

Note: Enhanced plastic and Military DSP versions are available for selected DSPs.

† Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order.

**TMS320C64x™ DSP Generation – Highest-Performance Fixed-Point DSPs**

Part Number	Internal RAM (Bytes)		McBSP	Enhanced DMA (Channels)	COM°	Timers	MHz	MIPS	Power (W)*		Voltage (V)		Packaging	1 KU (\$U.S.)†
	L1 Program Cache/ L1 Data Cache/ L2 Unified RAM/Cache								CPU and L1	Total	Core	I/O		
<b>Highest Performance</b>														
TMS320C6418GTS600	16K/16K/512K		2	64	HPI 32/16	3	600	4800†	0.6	1.5	1.4	3.3	288 BGA, 23 mm	55.94
TMS320C6414TGLZ6‡	16K/16K/1M		3	64	HPI 32/16	3	600	4800	0.6	1.5	1.1	3.3	532 BGA, 23 mm	85.85
TMS320C6414TGLZ7‡	16K/16K/1M		3	64	HPI 32/16	3	720	5760	0.6	1.7	1.2	3.3	532 BGA, 23 mm	107.32
TMS320C6414TGLZ8‡	16K/16K/1M		3	64	HPI 32/16	3	850	6800	TBD	TBD	1.2	3.3	532 BGA, 23 mm	170.69
TMS320C6414TGLZ1	16K/16K/1M		3	64	HPI 32/16	3	1000	8000	TBD	TBD	1.2	3.3	532 BGA, 23 mm	213.63
TMS320C6415TGLZ6‡	16K/16K/1M	2+Utopia*	64	64	PCI/HPI 32/16	3	600	4800	0.6	1.5	1.1	3.3	532 BGA, 23 mm	90.37
TMS320C6415TGLZ7‡	16K/16K/1M	2+Utopia*	64	64	PCI/HPI 32/16	3	720	5760	0.6	1.7	1.2	3.3	532 BGA, 23 mm	112.97
TMS320C6415TGLZ8‡	16K/16K/1M	2+Utopia*	64	64	PCI/HPI 32/16	3	850	6800	TBD	TBD	1.2	3.3	532 BGA, 23 mm	179.67
TMS320C6415TGLZ1	16K/16K/1M	2+Utopia*	64	64	PCI/HPI 32/16	3	1000	8000	TBD	TBD	1.2	3.3	532 BGA, 23 mm	224.87
TMS320C6416TGLZ6‡	16K/16K/1M	2+Utopia*	64	64	PCI/HPI 32/16	3	600	4800**	0.6	1.5	1.1	3.3	532 BGA, 23 mm	99.41
TMS320C6416TGLZ7‡	16K/16K/1M	2+Utopia*	64	64	PCI/HPI 32/16	3	720	5760**	0.6	1.7	1.2	3.3	532 BGA, 23 mm	124.26
TMS320C6416TGLZ8‡	16K/16K/1M	2+Utopia*	64	64	PCI/HPI 32/16	3	850	6800**	TBD	TBD	1.2	3.3	532 BGA, 23 mm	197.64
TMS320C6416TGLZ1	16K/16K/1M	2+Utopia*	64	64	PCI/HPI 32/16	3	1000	8000**	TBD	TBD	1.2	3.3	532 BGA, 23 mm	247.36
<b>TMS320C6455TZ7</b>	32K/32K/2M	2+Utopia†	64	64	Serial RapidIO™/HPI/ PCI/Gigabit EMAC	2§	720	5760	TBD	TBD	1.2	3.3, 1.8, 1.5, 1.2	697 ZTZ, 24 mm	202.27
<b>TMS320C6455TZ8</b>	32K/32K/2M	2+Utopia†	64	64	Serial RapidIO/HPI/ PCI/Gigabit EMAC	2§	850	6800	TBD	TBD	1.2	3.3, 1.8, 1.5, 1.2	697 ZTZ, 24 mm	247.47
<b>TMS320C6455TZ1</b>	32K/32K/2M	2+Utopia†	64	64	Serial RapidIO/HPI/ PCI/Gigabit EMAC	2§	1000	8000	TBD	TBD	1.2	3.3, 1.8, 1.5, 1.2	697 ZTZ, 24 mm	292.67

\*\* Plus on-chip Turbo (TCP) and VITERBI (VCP) coprocessors.

‡ Plus on-chip VITERBI (VCP) coprocessor.

† UTOPIA pins muxed with a second McBSP.

§ Extended temperature versions available for C6414T, C6415T and C6416T at 600, 720 and 850 MHz for additional charge.

Note: Enhanced plastic and Military DSP versions are available for selected DSPs.

\* Assumes 60% CPU utilization, 50% EMIF utilization (133 MHz for 1.4 V, 100 MHz for 1.2 V), 50% writes, 64-bits, 50% bit switching, 2 2-MHz McBSP at 100% utilization, and 2 75-MHz timers at 100% utilization. See SPRA811.

† Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order.

New devices are listed in red.

\* UTOPIA pins muxed with a third McBSP.

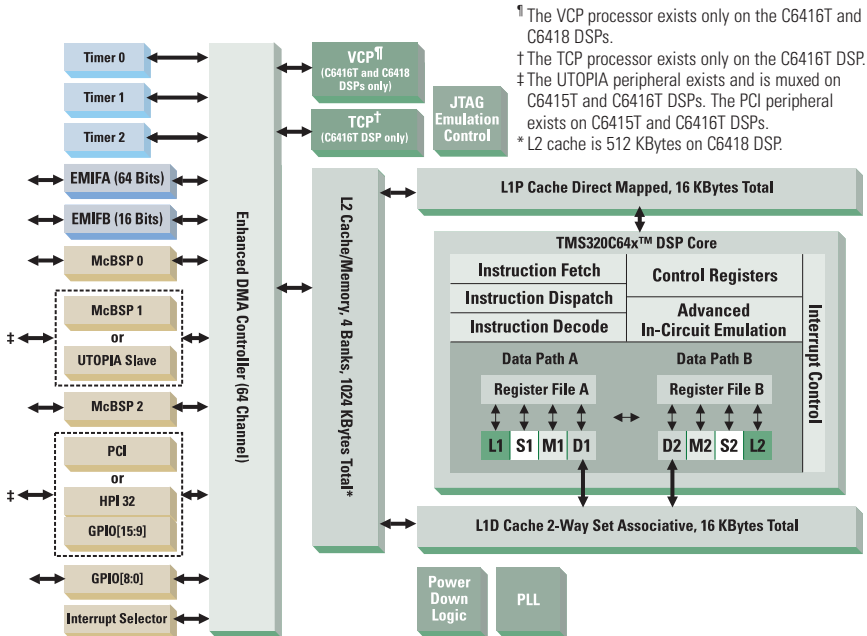
° HPI is selectable, 32-bit or 16-bit.

§ 64-bit configurable timers.

For details on TMS320DM64x™ digital media processors for video and imaging applications, go to page 14.



## Silicon



† The VCP processor exists only on the C6416T and C6418 DSPs.

† The TCP processor exists only on the C6416T DSP.

‡ The UTOPIA peripheral exists and is muxed on C6415T and C6416T DSPs. The PCI peripheral exists on C6415T and C6416T DSPs.

\* L2 cache is 512 KBytes on C6418 DSP.

### TMS320C6414T / C6415T / C6416T / C6418 DSP Block Diagram

With the highest-performance devices in the industry (up to 1 GHz based on 90-nm process technology), each C64x DSP is specifically designed to meet your needs by offering multiple peripheral options, and price points, code compatibility and scalability.

### Independent Benchmarks for Highest-Performance DSPs

The 1-GHz TMS320C64x™ DSP devices (TMS320C6414T / C6415T / C6416T) have been evaluated by Berkeley Design Technology, Inc. (BDTI), an independent provider of signal-processing technology analysis. The 1-GHz C64x™ DSP devices received a BDTImark2000™ score of 9130, which is the highest score BDTI has published for a mainstream DSP to date. The 720-MHz C64x DSP devices achieve a BDTImark2000 score of 6570.

(The BDTImark2000 provides a summary measure of DSP speed. For more information and scores, please see [www.BDTI.com](http://www.BDTI.com). Score © 2004 BDTI.)

### Independent Telecom Benchmarks for Performance Value DSPs

The Embedded Microprocessor Benchmark Consortium (EEMBC®) has conducted benchmarking for the new TMS320C6413 DSP, part of the Performance Value vector on our C6000™ roadmap. When analyzed on a performance per dollar basis, the C6413 DSP has achieved an impressive result of nine Telemarks per dollar. (Note: The C6413 DSP is priced at U.S. \$28.95 in 10 KU quantities.)

The TMS320C6413 DSP (500 MHz) was evaluated by two categories of benchmarking. In an out-of-the-box C-compiler test, the C6413 DSP achieved a score of

13.5 Telemarks, comparing very favorably with standard RISC processors. However, the real benefits of this highly parallel architecture are demonstrated after employing C-level optimizations, where the score jumped to 263.3 Telemarks.

The EEMBC benchmarks use an application-specific set of benchmarking code to allow microprocessors from many manufacturers to be compared in out-of-the-box C, optimized C and full fury configurations.

The out-of-the-box score is the maximum performance result that can be obtained

by compiling the benchmark C code without any modifications at all. All that is allowed is the changing of compiler settings.

The optimized C scores use pragmas and intrinsics to more fully realize the performance of the DSP in the C environment. The pragmas deliver more information to the compiler such as loop count information used for loop unrolling and data alignment. The intrinsics provide access to DSP instructions/functionality not easily expressed in the typical C runtime environment such as saturated arithmetic.

Before a processor's scores are published, the EEMBC Certification Laboratories (ECL) must execute and verify the benchmarks. ECL certification ensures that scores are repeatable and generated fairly in accordance with EEMBC's rules.

### TMS320C6000™ DSP Platform Benchmarks – EEMBC® Telemarks

TI Processor	Out-of-the-Box	Optimized C
TMS320C64x DSP at 1 GHz	27.1	526.5
TMS320C64x DSP at 720 MHz	19.5	379.1
TMS320C6413 DSP at 500 MHz	13.5	263.3
TMS320C62x™ DSP at 300 MHz	6.8	44.6



**TMS320C62x™ DSP Generation, Fixed Point**  
**TMS320C67x™ DSP Generation, Floating Point**

High-Performance DSPs

Get samples, datasheets, tools and app reports at: [www.ti.com/c6000](http://www.ti.com/c6000)

**Features**

- 100% code-compatible DSPs priced as low as \$9
- Advanced VLIW architecture
- Up to eight 32-bit instructions executed each cycle
- Eight independent, multi-purpose functional units and up to sixty-four 32-bit registers
- Industry's most advanced DSP C compiler and Assembly Optimizer maximize efficiency and performance

**C672x™ DSP**

- Sixty four 32-bit registers
- Large (32 KB) program cache
- Flexible boot options
- dMAX DMA engine tuned for audio performance

**C671x™ DSP**

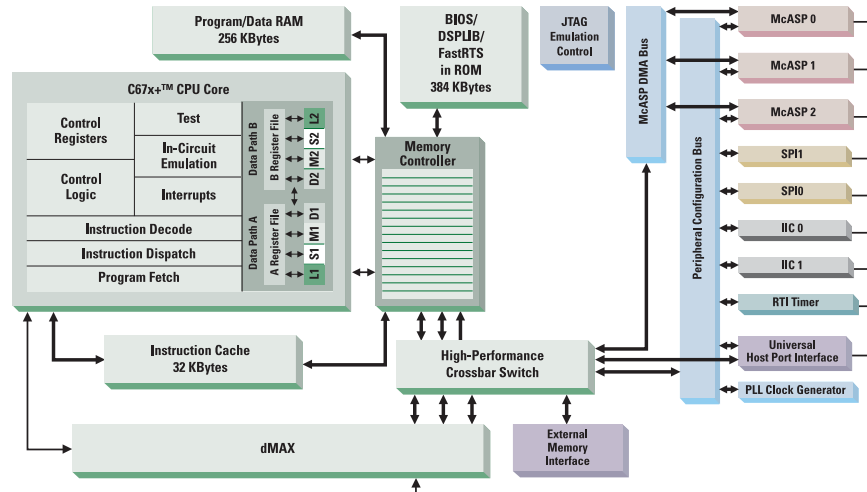
- L1/L2 cache architecture
- Thirty two 32-bit registers
- EDMA DMA engine

**C62x™ DSP**

- Sixteen-bit multiply, 32-bit instruction
- Up to 7 Mbit on-chip memory
- 32-bit PCI interface (C6205 DSP only)

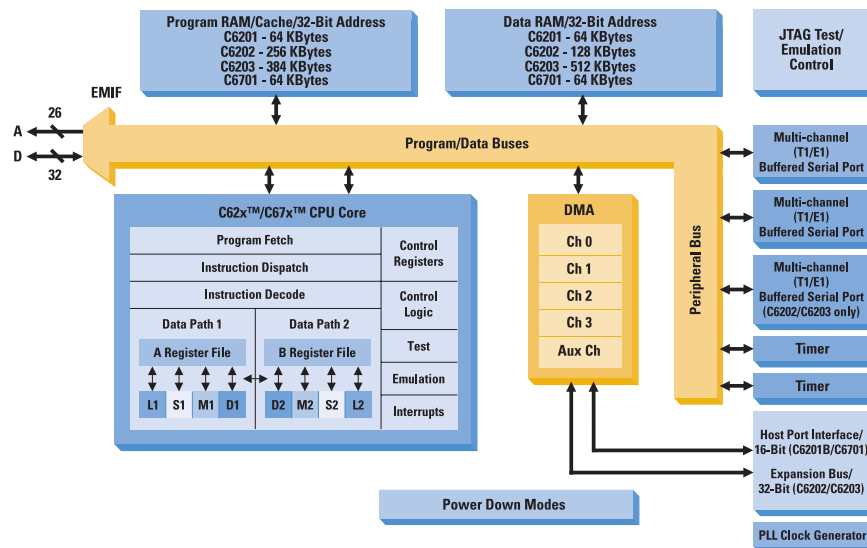
**Applications**

Professional audio products, mixers, effects boxes, audio synthesis, instrument/amplifier modeling, audio conferencing, audio broadcast, audio encoders, emerging audio applications, biometrics, medical, industrial applications, digital imaging, 3D graphics, speech recognition and voice over packet



**TMS320C6727 DSP Block Diagram**

TI's latest floating-point DSPs include the TMS320C6722, TMS320C6726 and the TMS320C6727 DSPs. These DSPs are ideal for a host of professional audio, musical instruments, broadcast audio and commercial audio applications. These devices will also perform exceptionally well in a variety of industrial, biometric, control and medical applications.



**TMS320C6201 / C6701 / C6202 / C6203 / C6204 / C6205 DSP Block Diagram**

The fixed-point C6201 DSP is pin-for-pin compatible with the floating-point C6701 DSP offering easy code transfer resulting in significant savings in development, resource and manufacturing costs. Pin compatibility between the C6202, C6203 and C6204 DSPs allow for easy migration between several memory, price and performance options. The C6205 DSP is the first TI DSP with on-chip PCI.



Silicon

## TMS320C62x™ DSP Generation – Fixed-Point DSPs

Part Number	RAM (Bytes)		McBSP	DMA	COM	MHz	Cycle (ns)	MIPS	Typical Activity Total Internal Power (W) (Full Device Speed)		Voltage (V)		Packaging	1 KU (U.S.) <sup>†</sup>
	Data	Prog							Core	I/O				
TMS320C6204GHK200 <sup>#</sup>	64K	64K	2	4	Exp. Bus/32	200	5	1600	0.8	1.5	3.3	288 BGA, 16 mm	9.66	
TMS320C6204GLV200	64K	64K	2	4	Exp. Bus/32	200	5	1600	0.8	1.5	3.3	340 BGA, 18 mm	21.90	
TMS320C6205GHK200 <sup>#</sup>	64K	64K	2	4	PCI/32	200	5	1600	0.8	1.5	3.3	288 BGA, 16 mm	10.43	
TMS320C6211BGFN150 <sup>#</sup>	4K/4K/64K*		2	16 <sup>†</sup>	HPI/16	150	6.7	1200	0.9	1.8	3.3	256 BGA, 27 mm	22.54	
TMS320C6211BGFN167	4K/4K/64K*		2	16 <sup>†</sup>	HPI/16	167	6	1336	1.0	1.8	3.3	256 BGA, 27 mm	28.18	
TMS320C6202BGNZ250 <sup>#</sup>	128K	256K	3	4	Exp. Bus/32	250	4	2000	0.9	1.5	3.3	352 BGA, 27 mm	58.57	
TMS320C6202BGNZ250	128K	256K	3	4	Exp. Bus/32	250	4	2000	0.9	1.5	3.3	384 BGA, 18 mm	58.57	
TMS320C6202BGNZ300	128K	256K	3	4	Exp. Bus/32	300	3.3	2400	1.0	1.5	3.3	352 BGA, 27 mm	70.29	
TMS320C6202BGNZ300	128K	256K	3	4	Exp. Bus/32	300	3.3	2400	1.0	1.5	3.3	384 BGA, 18 mm	70.29	
TMS320C6203BGNZ300	512K	384K	3	4	Exp. Bus/32	300	3.3	2400	1.3	1.5	3.3	352 BGA, 27 mm	74.96	
TMS320C6203BGNZ300	512K	384K	3	4	Exp. Bus/32	300	3.3	2400	1.3	1.5	3.3	384 BGA, 18 mm	74.96	
TMS320C6203BGNZ173 <sup>#</sup>	512K	384K	3	4	Exp. Bus/32	173	5.78	1384	1.1	1.5 <sup>°</sup>	3.3	352 BGA, 27 mm	63.26	
TMS320C6203BGNZ173	512K	384K	3	4	Exp. Bus/32	173	5.78	1384	1.1	1.5 <sup>°</sup>	3.3	384 BGA, 18 mm	63.26	
TMS320C6201GJC200 <sup>#</sup>	64K	64K	2	4	HPI/16	200	5	1600	1.3	1.8	3.3	352 BGA, 35 mm	86.57	
TMS320C6201GJL200 <sup>#</sup>	64K	64K	2	4	HPI/16	200	5	1600	1.3	1.8	3.3	352 BGA, 27 mm	86.57	

\* The C6211 DSP's 72 KBytes of cache memory is comprised of 4 KBytes data cache, 4 KBytes program cache and 64 KBytes unified cache memory.

<sup>†</sup> Enhanced DMA.

<sup>#</sup> Extended temperature versions available for C6201, C6202, C6203, C6204, C6205 and C6211 for additional charge.

<sup>°</sup> Device may operate at 300 MHz with 1.7-V core.

Note: All devices include two timers.

Note: Enhanced plastic and Military DSP versions are available for selected DSPs.

\* Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order.

## TMS320C67x™ DSP Generation – Floating-Point DSPs

Part Number	RAM (Bytes)		McBSP	McASP	DMA	COM	SPI / I <sup>2</sup> C	MHz	Cycle (ns)	MFLOPS	Typical Activity Total Internal Power (W) (Full Device Speed)		Voltage (V)		Packaging	1 KU (U.S.) <sup>†</sup>
	Data/Prog										Core	I/O				
TMS320C6712DGD150	4K/4K/64K*		2	–	16 <sup>°</sup>	–	–	150	6.7	900	0.7	1.2	3.3	272 BGA, 27 mm	14.49	
TMS320C6722RFP200* <sup>*</sup>	32K/128K/384K <sup>§</sup>		–	2	dMAX	UHPI	2 / 2	200	5	1200	TBD	1.2	3.3	144 PQFP, 22 mm	11.24	
TMS320C6722RFP225* <sup>*</sup>	32K/128K/384K <sup>§</sup>		–	2	dMAX	UHPI	2 / 2	225	4.4	1350	TBD	1.2	3.3	144 PQFP, 22 mm	13.05	
TMS320C6722RFP250* <sup>*</sup>	32K/128K/384K <sup>§</sup>		–	2	dMAX	UHPI	2 / 2	250	4	1500	TBD	1.2	3.3	144 PQFP, 22 mm	13.05	
TMS320C6711DGD200	4K/4K/64K*		2	–	16 <sup>°</sup>	HPI/16	–	200	5	1200	0.9	1.2	3.3	272 BGA, 27 mm	18.02	
TMS320C6726RFP225* <sup>*</sup>	32K/256K/384K <sup>§</sup>		–	3 <sup>‡</sup>	dMAX	UHPI	2 / 2	225	4.4	1350	TBD	1.2	3.3	144 PQFP, 22 mm	15.93	
TMS320C6726RFP250* <sup>*</sup>	32K/256K/384K <sup>§</sup>		–	3 <sup>‡</sup>	dMAX	UHPI	2 / 2	250	4	1500	TBD	1.2	3.3	144 PQFP, 22 mm	15.93	
TMS320C6713BPYP200	4K/4K/256K*		2 <sup>#</sup>	2 <sup>#</sup>	16 <sup>°</sup>	HPI/16	–	200	5	1200	1.0	1.2	3.3	208 TQFP, 28 mm	21.07	
TMS320C6727GDH250* <sup>*</sup>	32K/256K/384K <sup>§</sup>		–	3	dMAX	UHPI	2 / 2	250	4	1500	TBD	1.2	3.3	256 BGA, 17 mm	19.94	
TMS320C6727GDH300 <sup>†*</sup>	32K/256K/384K <sup>§</sup>		–	3	dMAX	UHPI	2 / 2	300	3.3	1800	TBD	1.2	3.3	256 BGA, 17 mm	22.54	
TMS320C6713BGDP225	4K/4K/256K*		2 <sup>#</sup>	2 <sup>#</sup>	16 <sup>°</sup>	HPI/16	–	225	4.4	1350	1.2	1.2	3.3	272 BGA, 27 mm	27.68	
TMS320C6713BGDP300	4K/4K/256K*		2 <sup>#</sup>	2 <sup>#</sup>	16 <sup>°</sup>	HPI/16	–	300	3.3	1800	TBD	1.4	3.3	272 BGA, 27 mm	36.82	
TMS320C6701GJC150	64K/64K		2	–	4	HPI/16	–	150	6.7	900	1.3	1.8	3.3	352 BGA, 35 mm	82.24	
TMSC6701GJC16719V	64K/64K		2	–	4	HPI/16	–	167	6	1000	1.4	1.9	3.3	352 BGA, 35 mm	124.66	

\* Format represents cache memory architecture: [data cache] / [program cache] / [unified cache].

<sup>§</sup> Format represents program cache / program or data memory / ROM.

<sup>\*</sup> Volume production scheduled for 4Q05.

<sup>\*</sup> Extended temperature versions available for C6722, C6726, C6727, C6713, C6711D DSPs.

<sup>†</sup> Also available in 256-pin BGA, 17-mm Pb-Free (ZDH) package.

<sup>#</sup> The C6713 DSP can be configured to have up to three serial ports in various McASP/McBSP combinations by not utilizing the HPI. Other configurable serial options include I<sup>2</sup>C and additional GPIO.

Note: All devices include two timers.

Note: Enhanced plastic and Military DSP versions are available for selected DSPs.

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New devices are listed in red.

<sup>°</sup> Enhanced DMA.

<sup>‡</sup> McASP2 DIT only.

**C6000™ DSP Platform Hardware and Software Development Tools**

Description	Part Number	\$U.S.*
<b>Hardware Development Tools†</b>		
TMS320C6713 DSP Starter Kit (DSK)	TMDSDSK6713 (U.S. part number) TMDSDSK6713-0E (European part number)	395
TMS320C6416 DSP Starter Kit (DSK)	TMDXDSK6416-T (U.S. part number) TMDXDSK6416-TE (European part number)	495
Fingerprint Authentication Development Tool (FADT)	TMDSFDCFP10	245
Network and Video Development Kit (NVDK)	TMDX3PNV6416S	4,495
Network and Video 1-GHz Development Kit (NVDK)	TMDXNVK6415-T (U.S. part number) TMDXNVK6415-TE (European part number)	4,495
<b>Professional Audio Development Kit (PADK)</b>	TMDXDPK6727 (U.S. part number) TMDXDPF6727-0E (European part number)	1,995
<b>JTAG Emulators</b>		
XDS560™ PCI-Based High-Performance JTAG Emulator	TMDSEMU560	3,995
XDS560 Blackhawk USB High-Performance JTAG Emulator	TMDSEMU560U (U.S. part number) TMDSEMU560U-0E (European part number)	2,995
XDS510PP-Plus – Parallel Port Emulator for Windows	TMDSEMUPP (U.S. part number) TMDSEMUPP-0E (European part number)	1,500
XDS510™ USB-Based Emulator for Windows	TMDSEMUUSB	1,995
<b>Software Development Tools</b>		
Code Composer Studio Platinum Edition Development Tools Bundled with Annual S/W Subscription Supports C6000 DSP, C5000™ DSP, C2000™ DSP and OMAP™ processor platforms	TMDSCCSALL-1	3,595
C6000 DSP Code Composer Studio Development Tools Annual Software Subscription for Version 2.x	TMDSSUB6000	600
Essential Guide to Getting Started with DSP CD-ROM Includes C6000 DSP Code Composer Studio 120-Day Free Evaluation Tools‡	SPRC119C ( <a href="http://www.dspvillage.ti.com/freetools">www.dspvillage.ti.com/freetools</a> )	Free
TMS320C6000 DSP Chip Support Library	SPRC090	Free
TMS320C62x™ DSP Library	SPRC091	Free
TMS320C62x DSP Image Library	SPRC093	Free
TMS320C64x™ DSP Library	SPRC092	Free
TMS320C64x DSP Image Library	SPRC094	Free
TMS320C67x™ DSP Library	SPRC121	Free
TMS320C67x DSP Fast Run-Time Support Library (Fast RTS)	SPRC060	Free

\* A TMS320C6413 EVM is available from Spectrum Digital ([www.spectrumdigital.com](http://www.spectrumdigital.com)), Spectrum Digital part number 701884.

*New tools are listed in red.*

‡ Includes full-featured Code Composer Studio Development Tools, code generation tools (C/C++ compiler/assembler/linker) and simulator all limited to 120 days.

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**C6000™ DSP Platform Tools and Software Documentation**

Software Reference Guides	Web Search Literature #	Software Reference Guides (Cont'd)	Web Search Literature #
TMS320C6000 DSP Optimizing C Compiler User's Guide	SPRU187	TMS320C6000 DSP/BIOS Application Programming Interface (API) Reference Guide	SPRU403
Debugger User's Guide	SPRU188	TMS320C6000 DSP Instruction Set Simulator	SPRU546
TMS320C6000 DSP Programmer's Guide	SPRU198	Code Coverage and Multi-Event Profiler User's Guide	SPRU624
TMS320C6000 DSP Assembly Language Tools User's Guide	SPRU186	TMS320C62x DSP Library Programmer's Reference	SPRU402
Code Composer Studio Getting Started Guide	SPRU509	TMS320C64x DSP Library Programmer's Reference	SPRU565
TMS320C67x DSP Library Programmer's Reference Guide	SPRU657	TMS320C64x DSP Image/Video Processing Library Programmer's Ref.	SPRU023
TMS320C6000 DSP Peripheral Support Library Programmer's Ref. Guide	SPRU273	TMS320C67x DSP Fast RTS Library User's Guide	SPRU100
TMS320C6000 DSP Chip Support Library API Reference Guide	SPRU401		
TMS320C6000 DSP DSK Board Support Library API User's Guide	SPRU432	<b>Product Bulletin</b>	
TMS320C62x DSP Image/Video Library Programmer's Reference	SPRU400	XDS560™ Emulator Product Bulletin	SPRB148
TMS320™ DSP/BIOS™ User's Guide	SPRU423		

Check the TI website for a complete listing of technical documentation including application notes.



## Tools, Software and Support

### C6000™ DSP and TMS320™ DSP Algorithm Standard Literature and Related Technical Documentation

Data Sheets	Web Search Literature #
TMS320C6201 DSP Data Sheet	SPRS051
TMS320C6202/TMS320C6202B DSP Data Sheet	SPRS104
TMS320C6203 DSP Data Sheet	SPRS086
TMS320C6204 DSP Data Sheet	SPRS152
TMS320C6205 DSP Data Sheet	SPRS106
TMS320C6211/TMS320C6211B DSP Data Sheet	SPRS073
TMS320C6701 DSP Data Sheet	SPRS067
TMS320C6711/TMS320C6711B DSP Data Sheet	SPRS088
TMS320C6712 DSP Data Sheet	SPRS148
TMS320C6713 DSP Data Sheet	SPRS186
TMS320C6722/TMS320C6726/TMS320C6727 DSP Data Sheet	SPRS268
TMS320C6410 DSP Data Sheet	SPRS247
TMS320C6412 DSP Data Sheet	SPRS219
TMS320C6413 DSP Data Sheet	SPRS247
TMS320C6414T/C6415T/C6416T DSP Data Sheet	SPRS226
TMS320C6418 DSP Data Sheet	SPRS241
TMS320C6455 DSP Data Sheet	SPRS276
Technical Briefs and Overviews	
TMS320C6000 DSP Technical Brief	SPRU197
TMS320C64x™ DSP Technical Overview	SPRU395
Hardware User's Guides	
TMS320C6000 DSP CPU and Instruction Set Reference Guide	SPRU189
TMS320C6000 DSP Peripherals Reference Guide	SPRU190
TMS320C62x™/C64x™ DSP FastRTS Library Programmer's Reference Guide	SPRU653
TMS320C6000 DSP Instruction Set Simulator Technical Overview	SPRU600
TMS320C6000 DSP Multi-channel Audio Serial Port (McASP) Reference Guide	SPRU041
TMS320C6000 DSP I <sup>2</sup> C Module Reference Guide	SPRU175
TMS320C6000 DSP Phase-Locked Loop (PLL) Controller Peripheral Reference Guide	SPRU233
TMS320C64x/C64x+ DSP CPU and Instruction Set Reference Guide	SPRU732

Software User's and Reference Guides	Web Search Literature #
TMS320C6000 DSP Programmer's Guide	SPRU198
Turbo Decoder Coprocessor User's Guide	SPRU534
TMS320C64x DSP VITERBI Decoder Coprocessor Reference Guide	SPRU533
Cache Analysis User's Guide	SPRU575
TMS320™ DSP Algorithm Standard Rules and Guidelines	SPRU352
TMS320 DSP Algorithm Standard API Reference	SPRU360
TMS320 DSP Algorithm Standard Demonstration Application	SPRU361
TMS320 DSP Algorithm Standard Developer's Guide	SPRU424
TMS320C6455 DSP Technical Reference	SPRU965
Product Bulletins	
TMS320C64x DSP Product Bulletin	SPRT236
TMS320C67x™ Floating-Point DSP Generation Product Bulletin	SPRT196
Application Notes	
How to Begin Development Today with the C6414, C6415, and C6416 DSPs	SPRA718
How to Begin Development Today with the C6713 Floating-Point DSP	SPRA809
TMS320C6414, C6415, and C6416 DSP Power Consumption Summary	SPRA811
Migrating from TMS320C6211B/TMS320C6711B to TMS320C6711C DSPs	SPRA837
TMS320C6713 Digital Signal Processor Optimized for High-Performance Multichannel Audio Systems	SPRA921
A Case Study in DSP Systems Integration – The TI 3rd Party Vocoder Demonstration	SPRA734
Making DSP Algorithms Compliant with the TMS320 DSP Algorithm Standard	SPRA579
The TMS320 DSP Algorithm Standard – White Paper	SPRA581
Using the TMS320 DSP Algorithm Standard in a Dynamic DSP System	SPRA580
Using the TMS320 DSP Algorithm Standard in a Static DSP System	SPRA577
TMS320C64x+ DSP Megamodule	SPRAA68
TMS320C64x to TMS320C64x+ DSP Migration	SPRAA84
White Papers	
The Future of DSP	SPRY049
Comparing Apples, Oranges and Gigahertz: Why is a DSP Gigahertz so Special?	SPRY050

Check the TI website for a complete listing of technical documentation including application notes.

### C6000 DSP Platform Support

C6000 DSP Application Notes	<a href="http://www.ti.com/c6000appnotes">www.ti.com/c6000appnotes</a>
C6000 DSP Benchmarks	<a href="http://www.ti.com/c6000bench">www.ti.com/c6000bench</a>
C6000 DSP Signal Processing Libraries	<a href="http://www.ti.com/c6000dsplib">www.ti.com/c6000dsplib</a>



### Power Management Products for the C6000™ DSP Platform

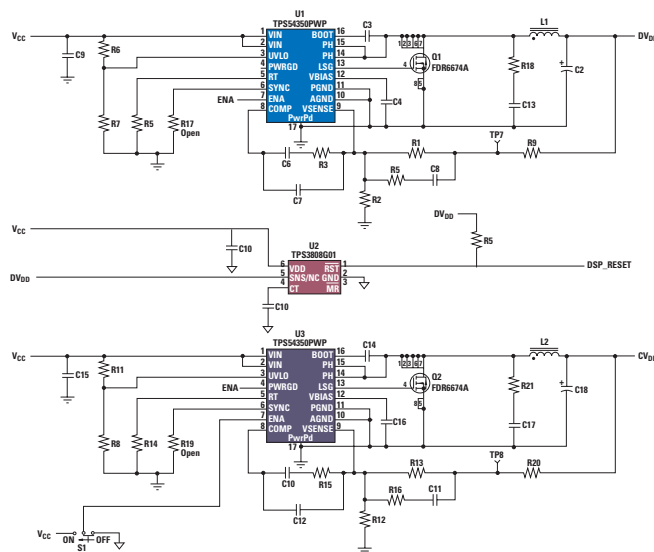
Get samples, datasheets, Evaluation Modules (EVMs) and app reports at: [power.ti.com](http://power.ti.com)

Suggested Power Management Solutions for the TMS320C64x™ DSP Generation						
DSP Part Number	Core	Core Switcher	Core Plug-In	Dual Plug-In	I/O LDO	I/O Switcher
3.3-V I/O (Core)	LDO	(w/ FETs)	Module	Module		(w/ FETs)
TMS320C6410-400 (1.2 V)	TPS79601	TPS62040	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320C6412-600 (1.4 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320C6412-500 (1.2 V)	TPS79601	TPS62040	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320C6413-600 (1.2 V)	TPS79601	TPS62040	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320C6418-600 (1.4 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320C6414T (1.1 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	-	TPS77333	TPS62007
TMS320C6414T (1.2 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320C6415T (1.1 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	-	TPS77333	TPS62007
TMS320C6415T (1.2 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007
TMS320C6416T (1.1 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	-	TPS77333	TPS62007
TMS320C6416T (1.2 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	PT6940	TPS77333	TPS62007

Suggested Power Management Solutions for the TMS320C67x™ DSP Generation						
DSP Part Number	Core	Core Switcher	Core Plug-In	Dual Plug-In	I/O LDO	I/O Switcher
3.3-V I/O (Core)	LDO	(w/ FETs)	Module	Module		(w/ FETs)
TMS320C6701-150 (1.8 V)	TPS75118	TPS54110	PTHxx000W <sup>1</sup>	PT6942	TPS77133	TPS62007
TMS320C6701-167 (1.9 V)	TPS75101	TPS54110	PTHxx000W <sup>1</sup>	PT6940	TPS77133	TPS62007
TMS320C6711D-200 (1.2 V)	TPS79601	TPS62040	PTHxx000W <sup>1</sup>	PT6940	TPS77133	TPS62007
TMS320C6712D-150 (1.2 V)	TPS79601	TPS62050	PTHxx050W <sup>1</sup>	PT6940	TPS77133	TPS62007
TMS320C6713B-200 (1.2 V)	TPS79601	TPS62040	PTHxx000W <sup>1</sup>	PT6940	TPS77133	TPS62007
TMS320C6713B-225 (1.4 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	PT6940	TPS77133	TPS62007
TMS320C6713B-300 (1.4 V)	TPS78601	TPS54110	PTHxx000W <sup>1</sup>	PT6940	TPS77133	TPS62007
TMS320C6722 (1.2 V)	TPS79601	TPS62040	PTHxx000W <sup>1</sup>	PT6940	TPS77133	TPS62007
TMS320C6726 (1.2 V)	TPS79601	TPS62040	PTHxx000W <sup>1</sup>	PT6940	TPS77133	TPS62007
TMS320C6727 (1.2 V)	TPS79601	TPS62040	PTHxx000W <sup>1</sup>	PT6940	TPS77133	TPS62007

Note 1: xx is determined by input bus voltage:  $V_{IN} = 12\text{ V}$  then  $xx = 12$ ,  $V_{IN} = 5\text{ V}$  then  $xx = 05$ , and  $V_{IN} = 3.3\text{ V}$  then  $xx = 03$ .

### Example C6000 DSP Power Supply Design



For additional power supply designs for TI DSPs, please visit [www.ti.com/dsppower](http://www.ti.com/dsppower).

**Note:** The TI power devices recommended here are based on standard operating conditions. System designers should use device power estimation tools in conjunction with overall application level power requirements to ensure an adequate power supply design is used.



## Logic Products

### Bus Interface Products

- The LVC and ALVC families offer  $V_{CC}$  fully specified to match the needs of the TMS320™ DSP family: 3.3 V, 2.5 V and 1.8 V
- Broad range of surface mount packaging options from SOIC to BGA
- Propagation delays of 3 ns and below
- Bus hold on data inputs decreases system component count by eliminating the need for external pull-up/pull-down resistors

### Little Logic

- Ability to place a single gate in critical locations provides for simplified routing and board space savings
- Single gates also provide easy state change for control inputs
- The NanoStar™ package provides the industry's smallest logic package

### Level Translation

- Interfacing any low-voltage component with legacy, high-voltage devices
- Protects a DSP that has non-over-voltage tolerant inputs

### Signal Switches

- Provide an optimized interface solution between DSPs and peripheral components
- Offer high-bandwidth (up to 500 MHz), low-power bus interfacing when signal buffering is not required
- Allow bidirectional data flow with near-zero propagation delay
- Support both digital and analog applications: PCI interface, USB interface, hot-card insertion, memory interleaving, bus isolation, level translation and low-distortion signal gating

### I/O Expansion

- I<sup>2</sup>C-to-parallel port expander
- Compatible with most processors and microcontrollers

### Bus Interface for TMS320 DSPs

Device	Description	Supply Voltage	t <sub>pd max</sub> (ns)	Package (Number of Pins)
SN74ALVC16244A	16-bit buffer/driver with 3-state outputs	3.3 V	3	TSSOP, SSOP(48)/VFBGA(56)
SN74ALVCH16244	16-bit buffer/driver with 3-state outputs	3.3 V	3	TSSOP, TVSOP, SSOP(48)/VFBGA(56)
SN74ALVCH16245	16-bit bus transceiver with 3-state outputs	3.3 V	3	TSSOP, TVSOP, SSOP(48)/VFBGA(56)
SN74ALVCH16373	16-bit transparent D-type latch with 3-state outputs	3.3 V	3.6	TSSOP, SSOP(48)/VFBGA(56)
SN74ALVCH16374	16-bit edge-triggered D-type flip-flop with 3-state outputs	3.3 V	4.2	TSSOP, SSOP(48)/VFBGA(56)
SN74ALVC16835	18-bit Universal Bus driver with 3-state outputs	3.3 V	3.6	TSSOP, TVSOP, SSOP, VFBGA(56)
SN74ALVCH16835	18-bit Universal Bus driver with 3-state outputs	3.3 V	3.6	TSSOP, TVSOP, SSOP, VFBGA(56)
SN74ALVCH162244	16-bit buffer/driver with 3-state outputs	3.3 V	4.2	TSSOP, SSOP(48)
SN74ALVCH162374	16-bit edge-triggered D-type flip-flop with 3-state outputs	3.3 V	4.6	TSSOP, SSOP(48)
SN74ALVC162835	18-bit Universal Bus driver with 3-state outputs	3.3 V	4.2	TSSOP, TVSOP, SSOP(56)
SN74ALVCH162835	18-bit Universal Bus driver with 3-state outputs	3.3 V	4.2	TSSOP, TVSOP, SSOP(56)
SN74LVC16244A	16-bit buffer/driver with 3-state outputs	3.3 V	4.1	TSSOP, TVSOP, SSOP(48)/VFBGA(56)
SN74LVCH16244A	16-bit buffer/driver with 3-state outputs	3.3 V	4.1	TSSOP, TVSOP, SSOP(48)/VFBGA(56)
SN74LVC16245A	16-bit bus transceiver with 3-state outputs	3.3 V	4	TSSOP, TVSOP, SSOP(48)/VFBGA(56)
SN74LVCH16245A	16-bit bus transceiver with 3-state outputs	3.3 V	4	TSSOP, TVSOP, SSOP(48)/VFBGA(56)
SN74LVC16373A	16-bit transparent D-type latch with 3-state outputs	3.3 V	4.2	TSSOP, TVSOP, SSOP(48)/VFBGA(56)
SN74LVCH16373A	16-bit transparent D-type latch with 3-state outputs	3.3 V	4.2	TSSOP, TVSOP, SSOP(48)/VFBGA(56)
SN74LVC16374A	16-bit edge-triggered D-type flip-flop with 3-state outputs	3.3 V	4.5	TSSOP, TVSOP, SSOP(48)/VFBGA(56)
SN74LVCH16374A	16-bit edge-triggered D-type flip-flop with 3-state outputs	3.3 V	4.5	TSSOP, TVSOP, SSOP(48)/VFBGA(56)

### Little Logic for TMS320 DSPs

Device	Description	Supply Voltage	t <sub>pd max</sub> (ns)	Package (Number of Pins)
SN74LVC1G00	Single 2-input positive-NAND gate	3.3 V	4.7	SOT, DSBGA (5)
SN74LVC1G04	Single inverter	3.3 V	4.2	SOT, DSBGA (5)
SN74LVC1G07	Single buffer/driver with open-drain output	3.3 V	4.2	SOT, DSBGA (5)
SN74LVC1G08	Single 2-input positive-AND gate	3.3 V	4.5	SOT, DSBGA (5)
SN74LVC1G10	Single 3-input positive-NAND gate	3.3 V	3.8	SOT, DSBGA (6)
SN74LVC1G11	Single 3-input positive-AND gate	3.3 V	4.1	SOT, DSBGA (6)
SN74LVC1G14	Single Schmitt-Trigger inverter	3.3 V	5.5	SOT, DSBGA (5)
SN74LVC1G19	1-of-2 decoder/demultiplexer	3.3 V	4	SOT, DSBGA (6)
SN74LVC1G27	Single 3-input positive-NOR gate	3.3 V	4.5	SOT, DSBGA (6)
SN74LVC1G32	Single 2-input positive-OR gate	3.3 V	4.5	SOT, DSBGA (5)
SN74LVC1G57	Configurable multiple-function gate	3.3 V	6.3	SOT, DSBGA (6)
SN74LVC1G58	Configurable multiple-function gate	3.3 V	6.3	SOT, DSBGA (6)
SN74LVC1G79	Single positive-edge-triggered D-type flip-flop	3.3 V	5.2	SOT, DSBGA (5)
SN74LVC1G97	Configurable multiple-function gate	3.3 V	6.3	SOT, DSBGA (6)
SN74LVC1G98	Configurable multiple-function gate	3.3 V	6.3	SOT, DSBGA (6)
SN74LVC1G125	Single bus buffer gate with 3-state outputs	3.3 V	4.5	SOT (5), DSBGA (5)
SN74LVC1G332	Single 3-input positive-OR gate	3.3 V	4.5	SOT, DSBGA (6)
SN74LVC1G386	Single 3-input positive-XOR gate	3.3 V	4.5	SOT, DSBGA (6)
SN74AUC1G00	Single 2-input positive-NAND gate	1.8 V	2.5	SOT, DSBGA (5)
SN74AUC1G04	Single inverter gate	1.8 V	2.5	SOT, DSBGA (5)
SN74AUC1G07	Single buffer/driver with open-drain output	1.8 V	2.5	SOT, DSBGA (5)
SN74AUC1G08	Single 2-input positive-AND gate	1.8 V	2.5	SOT, DSBGA (5)
SN74AUC1G14	Single Schmitt-Trigger inverter	1.8 V	2.8	SOT, DSBGA (5)
SN74AUC1G32	Single 2-input positive-OR gate	1.8 V	2.5	SOT, DSBGA (5)
SN74AUC1G79	Single positive-edge-triggered D-type flip-flop	1.8 V	1.9	SOT, DSBGA (5)
SN74AUC1G125	Single bus buffer gate with 3-state output	1.8 V	2.5	SOT (5), DSBGA (5)
SN74AUP1G08	Low-power single 2-input positive-AND gate	3.3 V	4.2	SOT (5)
SN74AUP1G57	Low-power configurable multiple-function gate	3.3 V	5.3	SOT (6)
SN74AUP1G58	Low-power configurable multiple-function gate	3.3 V	5.3	SOT (6)
SN74AUP1G97	Low-power configurable multiple-function gate	3.3 V	5.3	SOT (6)
SN74AUP1G98	Low-power configurable multiple-function gate	3.3 V	5.3	SOT (6)



### Level Translation for TMS320 DSPs

Device	Description	Bit Width	V <sub>CCA</sub> (V)	V <sub>CCB</sub> (V)	Package (Number of Pins)
SN74ALVC164245	16-bit dual 2.5-V to 3.3-V/3.3-V to 5-V level shifting transceiver with 3-state outputs	16	2.3 to 3.6	3 to 5.5	SSOP, TSSOP (48) / VFBGA (56)
SN74AVC8T245	8-bit dual-supply bus transceiver with configurable voltage translation and 3-state outputs	8	1.4 to 3.6	1.4 to 3.6	TSSOP, QFN (24)
SN74AVCA164245	16-bit dual-supply bus transceiver with configurable voltage translation and 3-state outputs	16	1.4 to 3.6	1.4 to 3.6	TSSOP(48) / VFBGA (56)
SN74AVCB164245	32-bit dual-supply bus transceiver with configurable voltage translation and 3-state outputs	32	1.4 to 3.6	1.4 to 3.6	LFBGA (96)
SN74LVC1T45	Single-bit dual-supply bus transceiver with configurable voltage translation and 3-state outputs	1	1.65 to 5.5	1.65 to 5.5	SOT, DSBGA (6)
SN74LVC2T45	Dual-bit dual-supply transceiver with configurable voltage translation and 3-state outputs	2	1.65 to 5.5	1.65 to 5.5	SSOP, VSSOP, DSBGA (8)
SN74LVC4245A	Octal bus transceiver and 3.3-V to 5-V shifter with 3-state outputs	8	4.5 to 5.5	2.7 to 3.3	SSOP, SOIC, TSSOP (24)
SN74LVCC4245A	Octal bus transceiver with adjustable output voltage and 3-state outputs	8	4.5 to 5.5	2.7 to 3.3	SSOP, SOP, SOIC, TSSOP (24)
SN74LVCC3245A	Octal bus transceiver with adjustable output voltage and 3-state outputs	8	2.3 to 3.3	2.7 to 5.5	SSOP, SOP, SOIC, TSSOP (24)

### Signal Switches for TMS320 DSPs

Device	Description	Supply Voltage (V)	t <sub>pd max</sub> (ns)	Package (Number of Pins)
SN74CB3Q3253	High-bandwidth dual 1-of-4 FET multiplexer/demultiplexer	2.3 to 3.6	0.18	SSOP, TVSOP, TSSOP, QFN (16)
SN74CB3Q3257	High-bandwidth 4-bit 1-of-2 FET multiplexer/demultiplexer	2.3 to 3.6	0.2	SSOP, TVSOP, TSSOP, QFN (16)
SN74CB3Q3306A	High-bandwidth dual-FET bus switch	2.3 to 3.6	0.2	VSSOP, TSSOP (8)
SN74CB3Q3125	High-bandwidth quadruple-FET bus switch	2.3 to 3.6	0.2	SSOP (16), TVSOP, TSSOP, QFN (14)
SN74CB3Q3384A	High-bandwidth 10-bit FET bus switch	2.3 to 3.6	0.15	SSOP, TVSOP, TSSOP (24)
SN74CB3T3253	Dual 1-of-4 FET multiplexer/demultiplexer with 5-V tolerant level shifter	2.3 to 3.6	0.25	SOIC, SSOP, TVSOP, TSSOP (16)
SN74CB3T3257	Dual 1-of-2 FET multiplexer/demultiplexer with 5-V tolerant level shifter	2.3 to 3.6	0.25	TVSOP, TSSOP (16)
SN74CB3T1G125	Single 1-bit FET bus switch with 5-V tolerant level shifter	2.3 to 3.6	0.25	SOP (5)
SN74CB3T3306	Dual-FET bus switch with 5-V tolerant level shifter	2.3 to 3.6	0.25	SSOP, VSSOP (8)
SN74CB3T3125	Quadruple-FET bus switch with 5-V tolerant level shifter	2.3 to 3.6	0.25	TVSOP, TSSOP (14)
SN74CB3T3384	10-bit FET bus switch with 5-V tolerant level shifter	2.3 to 3.6	0.25	SSOP, SOIC, TSSOP (24)
SN74CBTLV3251	1-of-8 FET multiplexer/demultiplexer	2.3 to 3.6	0.25	SOIC, SSOP, TVSOP, TSSOP, QFN (16)
SN74CBTLV3253	Dual 1-of-4 FET multiplexer/demultiplexer	2.3 to 3.6	0.25	SOIC, SSOP, TVSOP, TSSOP, QFN (16)
SN74CBTLV3257	4-bit 1-of-2 FET multiplexer/demultiplexer	2.3 to 3.6	0.25	SOIC, SSOP, TVSOP, TSSOP, QFN (16)
SN74CBTLV1G125	Single 1-bit FET bus switch	2.3 to 3.6	0.25	SOP (5)
SN74CBTLV3125	Quadruple-FET bus switch	2.3 to 3.6	0.25	SSOP (16), SOIC, SOP, TVSOP, TSSOP, QFN (14)
SN74CBTLV3384	10-bit FET bus switch	2.3 to 3.6	0.25	SOIC, SSOP, TVSOP, TSSOP (24)
SN74LVC1G3157	Single-pole, double-throw (SPDT) analog switch	1.65 to 5.5	0.3	SOP, DSBGA (6)
SN74AUC2G53	Single pole, double-throw (SPDT) analog switch or 2:1 analog multiplexer/demultiplexer	0.8 to 2.7	0.1	SSOP, VSSOP (8)
SN74AUC2G66	Dual-bilateral analog switch	0.8 to 2.7	0.4	SSOP, VSSOP (8)

### I/O Expansion for TMS320 DSPs

Device	Description	Supply Voltage	t <sub>pd max</sub> (ns)	Package (Number of Pins)
PCF8574	Remote 8-bit I/O expander for I <sup>2</sup> C bus	3.3 V	NA	PDIP, SOIC (16) / TSSOP (20)
PCF8574A	Remote 8-bit I/O expander for I <sup>2</sup> C bus	3.3 V	NA	PDIP, SOIC (16) / TSSOP (20)



## ADCs, DACs, CODECs and Special Functions

### Data Converters Plug-In for Texas Instruments Code Composer Studio™ IDE

TI's Data Converter Plug-In (DCP) is a free development tool that allows the creation of initialization data and configuration software for TI data converters from within the Integrated Development Environment (IDE) of Code Composer Studio. It provides easy-to-use windows for "point-and-click" data converter configuration from within the IDE, preventing illegal combinations of settings. The DCP dialog allows the user to select all the different settings for the data converter from a single screen and to automatically generate the interface software with a single mouse click. The generated well-documented C-source files contain all functions necessary to talk to the external data converter and to set up all of the registers internal to this device. The minimum function set includes read/write functions (single words and blocks of data), initialization functions and data structures and some device-specific functions like power down.

The generated code is to a great extent hardware independent, so it can be used together with the analog evaluation modules (EVMs) from our modular EVM system, our DSP Starter Kits (DSKs) or with your own custom board.

To download your free 3.5 version of the Data Converter Plug-In for Code Composer Studio IDE, please go to [www.ti.com/sc/dcplug-in](http://www.ti.com/sc/dcplug-in)

New devices are added to the tool on a regular basis.

Device	Description	C28x™	C54x™	C55x™	C6000™	C64x™
<b>ADCs</b>						
ADS803/4/5	12-bit, 5/10/20 MSPS, 1 channel	—	—	X	X	X
ADS1216/17/18	24-bit, 0.78 kSPS, 8 channel	—	X	X	X	—
ADS1240/41	24-bit, 15 SPS, 4/8 channel	—	X	—	X	—
ADS1251/52	24-bit, 20/40 kSPS, 1 channel	—	X	X	X	—
ADS1253/54	24-bit, 20 kSPS, 4 channel, 1.8–3.6V / 5V	—	X	—	X	—
ADS1271	24-bit, 105 kSPS, 1 channel	—	—	—	X	—
ADS1601/02	16-bit, 1.25/2.5 MSPS, 1 channel	—	—	X	X	X
ADS1605/25	16-/18-bit, 5/1.25 MSPS, 1 channel, 3.3-V I/O, 5-V analog	—	—	X	X	X
ADS1606/26	16-/18-bit, 5/1.25 MSPS, 1 channel, 3.3-V I/O, 5-V analog, 16-word FIFO	—	—	X	X	X
ADS7841/44	12-bit, 200 kSPS, 4/8 channel	—	X	—	—	—
ADS7861	12-bit, 500 kSPS, 2+2 channel	X	X	X	X	X
ADS8320/21/25	16-bit, 100 kSPS, 1 channel, 2.7–5 V	—	X	—	—	—
ADS8322/23	16-bit, 500 kSPS, 1 channel, 5 V	—	—	X	X	X
ADS8324	14-bit, 50 kSPS, 1 channel, 1.8–3.6 V	—	X	—	—	—
ADS8361	16-bit, 500 kSPS, 4 channel	X	X	X	X	X
ADS8364	16-bit, 250 kHz, 6 channel	—	X	—	X	X
ADS8381/83	18-bit, 570/500 kSPS, 1 channel	—	—	X	X	X
ADS8401/2	16-bit, 2 MSPS, 1 channel uni-/bi-polar	—	—	X	X	X
ADS8411/12	16-bit, 2 MSPS, 1 channel uni-/bi-polar	—	—	X	X	X
PCM1804	24-bit, 192 kSPS, stereo	—	X	X	X	X
PCM4202	24-bit, 192 kSPS, stereo	—	X	X	X	X
THS1007/09	10-bit, 8 MSPS, 4/2 channel	—	—	—	—	—
THS10064/82	10-bit, 8 MSPS, 4/2 channel, 16-word FIFO	X	X	X	X	X
THS1206	12-bit, 6 MSPS, 4 channel, 16-word FIFO	X	X	X	X	X
THS1207/09	12-bit, 8 MSPS, 4 channel	—	—	—	—	—
THS12082	12-bit, 8 MSPS, 2 channel, 16-word FIFO	X	X	X	X	X
THS1401/03/08	14-bit, 1/3/8 MSPS, 1 channel	—	—	—	—	—
THS14F01/03	14-bit, 1/3 MSPS, 1 channel, 32-word FIFO	—	—	—	—	—
TLC1514/18	10-bit, 400 kSPS, 4/8 channel	—	X	—	X	—
TLC2551	12-bit, 400 kSPS, 1 channel, 5 V	—	X	—	—	—
TLC2552/55	12-bit, 175 kSPS, 2/1 channel, 5 V	—	X	—	—	—
TLC2554/58	12-bit, 400 kSPS, 4/8 channel	—	X	—	—	—
TLC2574/78	12-bit, 200 kSPS, 4/8 channel, 5 V	—	X	—	—	—
TLC3541	14-bit, 200 kSPS, 1 channel, 5 V	—	X	—	X	—
TLC3544/48	14-bit, 200 kSPS, 4/8 channel, 5 V	—	X	—	—	—
TLC3545	14-bit, 200 kSPS, 1 channel, 5 V	—	X	—	X	—
TLC3574/78	14-bit, 200 kSPS, 4/8 channel, 5 V	—	X	—	—	—
TLC4541/45	16-bit, 200 kSPS, 1 channel, 5 V	—	X	—	X	—
TLV1504/08	10-bit, 200 kSPS, 4/8 channel	—	X	—	X	—
TLV1570	10-bit, 1.25 MSPS, 8 channel	—	X	—	—	—
TLV1571/78	10-bit, 1.25 MSPS, 1/8 channel	—	X	—	X	—
TLV1572	10-bit, 1.25 MSPS, 1 channel, S and H	—	X	—	—	—
TLV2541	12-bit, 200 kSPS, 1 channel, 2.7–5.5 V	—	X	—	—	—
TLV2542/45	12-bit, 140–200 kSPS, 2/1 channel, 2.7–5.5 V	—	X	—	—	—
TLV2544/48	12-bit, 200 kSPS, 4/8 channel	—	X	—	X	—
TLV2553/56	12-bit, 200 kSPS, 11 channel, int. reference	X	X	X	X	X

**NOTE:** An X indicates that the data converter plug-in generates the interface software for the specified TMS320 DSP generation, which not only configures the data converter, but also the DSP peripheral the device is connected to (e.g., the serial port or the memory interface). If no X is present, only the register settings, but no interface functions, are generated.

## ADCs, DACs, CODECs and Special Functions



Device	Description	C28x™	C54x™	C55x™	C6000™	C64x™
<b>DACs</b>						
DAC1220/21	16-bit, 1 channel, 2 ms	—	—	—	—	—
DAC7512/13	12-bit, 1 channel, 2.7–5.5 V, int./ext. reference	—	—	—	—	—
DAC8501	16-bit, 1 channel, 2.7–5.5 V, 10 μs, MDAC	X	X	X	X	X
DAC8531	16-bit, 1 channel, 2.7–5.5 V, 10 μs	X	X	X	X	X
DAC8532/34	16-bit, 2/1 channel, 2.7–5.5 V, 10 μs	X	X	X	X	X
DAC8580	16-bit, 1 channel, 1 μs	—	—	—	X	—
TLC5618A	12-bit, 2 channel, 5 V	—	X	—	X†	—
TLV5604/14	12-/10-bit, 3 μs, 4 channel, 2.7–5.5 V	—	—	—	—	—
TLV5606/16	10-/12-bit, 1 channel, 2.7–5.5 V	—	X	—	X†	—
TLV5608	10-bit, 1 μs, 8 channel, 2.7–5.5 V	—	—	—	—	—
TLV5610	12-bit, 1 μs, 8 channel, 2.7–5.5 V	—	—	—	—	—
TLV5617A/18A	10-/12-bit, 2 channel, 2.7–5.5 V	—	X	—	X†	—
TLV5623/25	8-bit, 1/2 channel, 2.7–5.5 V	—	X	—	X†	—
TLV5624/26	8-bit, 1/2 channel, 2.7–5.5 V, int. reference	—	X	—	X†	—
TLV5629	8-bit, 1 μs, 8 channel, 2.7–5.5 V	—	—	—	—	—
TLV5630/31/32	12-/10-/8-bit, 1 μs, 8 channel, 2.7–5.5 V	—	—	—	—	—
TLV5636/38	12-bit, 1/2 channel, 2.7–5.5 V, int. reference	—	X	—	X†	—
TLV5637	10-bit, 2 channel, 2.7–5.5 V, int. reference	—	X	—	X†	—
<b>CODECs</b>						
AIC111	16-bit, 40 kSPS, 1 channel, 1.3 V	—	X	—	—	—
PCM3002	16-/20-bit, 48 kSPS, stereo	—	X	—	X	—
TLV320AIC10	16-bit, 22 kSPS	—	X	—	X	—
TLV320AIC11	16-bit, 22 kSPS, 1.1–3.6 V I/O	—	X	—	X	—
TLV320AIC12	16-bit, 26 kSPS, 1 channel	—	X	X	X	X
TLV320AIC13	16-bit, 26 kSPS, 1 channel, 1.1-V I/O	—	X	X	X	X
TLV320AIC14	16-bit, 26 kSPS, 1 channel	—	X	X	X	X
TLV320AIC20	16-bit, 26 kSPS, 2 channel, 3.3-V I/O	—	X	X	X	X
TLV320AIC21	16-bit, 26 kSPS, 1 channel, 1.1-V I/O	—	X	X	X	X
TLV320AIC22C	Dual-VoIP CODEC	—	X	X	X	X
TLV320AIC23	24-Bit, 96 kHz, stereo	—	X	X	X	X
TLV320DAC23	16-/20-/24-/32-bit, 96 kSPS, stereo DAC	—	—	—	—	—
TLC320AIC24	16-bit, 26 kSPS, 1 channel, 3.3-V I/O	—	X	X	X	X
TLC320AIC25	16-bit, 26 kSPS, 1 channel, 1.1-V I/O	—	X	X	X	X
<b>Special Functions</b>						
AFE1230	G.SHDSL analog front end	—	—	X	—	—
AMC7820	Analog monitoring and control circuitry	—	X	—	X	—

† These DACs share the same driver.

NOTE: An X indicates that the data converter plug-in generates the interface software for the specified TMS320 DSP generation, which not only configures the data converter, but also the DSP peripheral the device is connected to (e.g., the serial port or the memory interface). If no X is present, only the register settings, but no interface functions are generated.


**MSP430 Microcontrollers: Ultra-Low-Power, 16-Bit RISC**
**Key Features**

- Ultra-low-power architecture extends battery life:
  - 0.1μA RAM retention
  - 0.8μA real-time clock mode
  - 250μA/MIPS active
- Wide range of integrated intelligent peripherals offload the CPU
- Modern 16-bit RISC CPU enables new applications at a fraction of the code size
- In-system programmable Flash permits flexible code changes, field upgrades and data logging
- Complete integrated development environment starting at U.S. \$99
- Device pricing as low as U.S. \$0.49

**Key Applications**

- Utility metering
- Portable instrumentation
- Intelligent sensing

**MSP-FET430 Flash Emulation Tool**

- JTAG-based real-time in-system emulation
- Target board, interface box, cable and samples
- CD-ROM includes IDE, assembler, linker, simulator and 8-KB C-compiler

The Flash Emulation Tool (FET) supports complete in-system development and is available for all the MSP430 Flash devices. Programming, assembler/C source-level debug, single stepping, multiple hardware breakpoints, full-speed operation and peripheral access are all fully supported in-system using JTAG. The FET comes complete with everything required to complete an entire project for only U.S. \$99.

(C) ROM (F) Flash	Program	SRAM	I/O	DMA	Timer_A 16-Bit Channels	Timer_B 16-Bit Channels
<b>Flash/ROM-Based x1xx Family with 16-Bit Watchdog (V<sub>CC</sub> 1.8–3.6 V)</b>						
MSP430F1101A	1 KB	128	14	—	3	—
MSP430C1101	1 KB	128	14	—	3	—
MSP430F1111A	2 KB	128	14	—	3	—
MSP430C1111	2 KB	128	14	—	3	—
MSP430F1121A	4 KB	256	14	—	3	—
MSP430C1121	4 KB	256	14	—	3	—
MSP430F1122	4 KB	256	14	—	3	—
MSP430F1132	8 KB	256	14	—	3	—
MSP430F122	4 KB	256	22	—	3	—
MSP430F123	8 KB	256	22	—	3	—
MSP430F1222	4 KB	256	22	—	3	—
MSP430F1232	8 KB	256	22	—	3	—
MSP430F133	8 KB	256	48	—	3	3
MSP430C1331	8 KB	256	48	—	3	3
MSP430F135	16 KB	512	48	—	3	3
MSP430C1351	16 KB	512	48	—	3	3
MSP430F147	32 KB	1024	48	—	3	7
MSP430F1471	32 KB	1024	48	—	3	7
MSP430F148	48 KB	2048	48	—	3	7
MSP430F1481	48 KB	2048	48	—	3	7
MSP430F149	60 KB	2048	48	—	3	7
MSP430F1491	60 KB	2048	48	—	3	7
MSP430F155	16 KB	512	48	✓	3	3
MSP430F156	24 KB	1024	48	✓	3	3
MSP430F157	32 KB	1024	48	✓	3	3
MSP430F167	32 KB	1024	48	✓	3	7
MSP430F168	48 KB	2048	48	✓	3	7
MSP430F169	60 KB	2048	48	✓	3	7
MSP430F1610	32 KB	5120	48	✓	3	7
MSP430F1611	48 KB	10240	48	✓	3	7
MSP430F1612	55 KB	5120	48	✓	3	7
(F) Flash	Program	SRAM	I/O	DMA	Timer_A 16-Bit Channels	Timer_B 16-Bit Channels
<b>Flash/ROM-Based F2xx Family With 16 MIPS and 16-Bit Watchdog (V<sub>CC</sub> 1.8–3.6 V)</b>						
MSP430F2101	1K	128	14	—	3	—
MSP430F2111	2K	128	14	—	3	—
MSP430F2121	4K	256	14	—	3	—
MSP430F2131	8K	256	14	—	3	—
(C) ROM (F) Flash	Program	SRAM	I/O	DMA	LCD Seg (8-Bit Basic Timer)	Timer_A 16-Bit Channels
<b>Flash/ROM-Based x4xx Family With LCD Driver and 16-Bit Watchdog (V<sub>CC</sub> 1.8–3.6 V)</b>						
MSP430F412	4 KB	256	48	—	96	3
MSP430C412	4 KB	256	48	—	96	3
MSP430F413	8 KB	256	48	—	96	3
MSP430C413	8 KB	256	48	—	96	3
MSP430F415	16 KB	512	48	—	96	3, 5
MSP430F417	32 KB	1024	48	—	96	3, 5
MSP430FW423	8 KB	256	48	—	96	3, 5
MSP430FW425	16 KB	512	48	—	96	3, 5
MSP430FW427	32 KB	1024	48	—	96	3, 5
MSP430F4250	16 KB	256	32	—	56	3
MSP430F4260	24 KB	256	32	—	56	3
MSP430F4270	32 KB	256	32	—	56	3
MSP430F423	8 KB	256	14	—	128	3
MSP430F425	16 KB	512	14	—	128	3
MSP430F427	32 KB	1024	14	—	128	3
MSP430FE423	8 KB	256	14	—	128	3
MSP430FE425	16 KB	512	14	—	128	3
MSP430FE427	32 KB	1024	14	—	128	3
MSP430F435	16 KB	512	48	—	128/160	3
MSP430F436	24 KB	1024	48	—	128/160	3
MSP430F437	32 KB	1024	48	—	128/160	3
MSP430FG437	32 KB	1024	48	✓	128	3
MSP430FG438	48 KB	2048	48	✓	128	3
MSP430FG439	60 KB	2048	48	✓	128	3
MSP430F447	32 KB	1024	48	—	160	3
MSP430F448	48 KB	2048	48	—	160	3
MSP430F449	60 KB	2048	48	—	160	3

<sup>1</sup>Suggested 1,000 unit resale price in U.S. dollars.

All production parts support industrial temperature range.

MSP430 Microcontrollers: Ultra-Low-Power, 16-Bit RISC



	USART	I <sup>2</sup> C	SVS	Brown-Out Reset	MPY	Comp_A	Temp Sensor	ADC	Additional Analog	Pins/Pkg	Price <sup>1</sup>
—	—	—	—	—	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$0.99
—	—	—	—	—	—	✓	—	slope	—	20 DW, PW, 24 RGE	\$0.60
—	—	—	—	—	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$1.35
—	—	—	—	—	—	✓	—	slope	—	20 DW, PW, 24 RGE	\$1.10
—	—	—	—	—	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$1.70
—	—	—	—	—	—	✓	—	slope	—	20 DW, PW, 24 RGE	\$1.35
—	—	—	—	✓	—	—	✓	5-ch ADC10	—	20 DW, PW, 32 RHB	\$2.00
—	—	—	—	✓	—	—	✓	5-ch ADC10	—	20 DW, PW, 32 RHB	\$2.25
1	—	—	—	—	—	✓	—	slope	—	28 DW, PW, 32 RHB	\$2.15
1	—	—	—	—	—	✓	—	slope	—	28 DW, PW, 32 RHB	\$2.30
1	—	—	—	✓	—	—	✓	8-ch ADC10	—	28 DW, PW, 32 RHB	\$2.40
1	—	—	—	✓	—	—	✓	8-ch ADC10	—	28 DW, PW, 32 RHB	\$2.50
1	—	—	—	—	—	✓	✓	8-ch ADC12	—	64 PM, RTD, PAG	\$3.00
1	—	—	—	—	—	✓	—	slope	—	64 PM	\$2.00
1	—	—	—	—	—	✓	✓	8-ch ADC12	—	64 PM, RTD, PAG	\$3.60
1	—	—	—	—	—	✓	—	slope	—	64 PM	\$2.30
2	—	—	—	—	✓	✓	✓	8-ch ADC12	—	64 PM, RTD, PAG	\$5.05
2	—	—	—	—	✓	✓	—	slope	—	64 PM, RTD	\$4.60
2	—	—	—	—	✓	✓	✓	8-ch ADC12	—	64 PM, RTD, PAG	\$5.75
2	—	—	—	—	✓	✓	—	slope	—	64 PM, RTD	\$5.30
2	—	—	—	—	✓	✓	✓	8-ch ADC12	—	64 PM, RTD, PAG	\$6.05
2	—	—	—	—	✓	✓	—	slope	—	64 PM, RTD	\$5.60
1	✓	✓	✓	✓	—	✓	✓	8-ch ADC12	(2) DAC12	64 PM, RTD	\$4.95
1	✓	✓	✓	✓	—	✓	✓	8-ch ADC12	(2) DAC12	64 PM, RTD	\$5.55
1	✓	✓	✓	✓	—	✓	✓	8-ch ADC12	(2) DAC12	64 PM, RTD	\$5.85
2	✓	✓	✓	✓	✓	✓	✓	8-ch ADC12	(2) DAC12	64 PM, RTD	\$6.75
2	✓	✓	✓	✓	✓	✓	✓	8-ch ADC12	(2) DAC12	64 PM, RTD	\$7.45
2	✓	✓	✓	✓	✓	✓	✓	8-ch ADC12	(2) DAC12	64 PM, RTD	\$7.95
2	✓	✓	✓	✓	✓	✓	✓	8-ch ADC12	(2) DAC12	64 PM, RTD	\$8.25
2	✓	✓	✓	✓	✓	✓	✓	8-ch ADC12	(2) DAC12	64 PM, RTD	\$8.65
2	✓	✓	✓	✓	✓	✓	✓	8-ch ADC12	(2) DAC12	64 PM, RTD	\$8.95
UART SPI	I <sup>2</sup> C IrDA	SVS	Brown-Out Reset	MPY	Comp_A	Temp Sensor	ADC	Additional Analog	Pins/Pkg	Price <sup>1</sup>	
—	—	—	✓	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$0.99	
—	—	—	✓	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$1.35	
—	—	—	✓	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$1.70	
—	—	—	✓	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$2.05	
Timer_B 16-Bit Channels	USART	SVS	Brown-Out Reset	MPY	Comp_A	Temp Sensor	ADC	Additional Analog	Pins/Pkg	Price <sup>1</sup>	
—	—	✓	✓	—	✓	—	slope	—	64 PM, RTD	\$2.60	
—	—	✓	✓	—	✓	—	slope	—	64 PM, RTD	\$1.90	
—	—	✓	✓	—	✓	—	slope	—	64 PM, RTD	\$2.95	
—	—	✓	✓	—	✓	—	slope	—	64 PM, RTD	\$2.10	
—	—	✓	✓	—	✓	—	slope	—	64 PM	\$3.40	
—	—	✓	✓	—	✓	—	slope	—	64 PM	\$3.90	
—	—	✓	✓	—	✓	—	slope	Flow-meter	64 PM	\$3.75	
—	—	✓	✓	—	✓	—	slope	Flow-meter	64 PM	\$4.05	
—	—	✓	✓	—	✓	—	slope	Flow-meter	64 PM	\$4.45	
—	—	—	✓	—	—	✓	SD16	(1) DAC12	48 DL, RGZ	\$3.10	
—	—	—	✓	—	—	✓	SD16	(1) DAC12	48 DL, RGZ	\$3.45	
—	—	—	✓	—	—	✓	SD16	(1) DAC12	48 DL, RGZ	\$3.80	
—	1	✓	✓	✓	—	✓	(3) SD16	—	64 PM	\$4.50	
—	1	✓	✓	✓	—	✓	(3) SD16	—	64 PM	\$4.95	
—	1	✓	✓	✓	—	✓	(3) SD16	—	64 PM	\$5.40	
—	1	✓	✓	✓	—	✓	(3) SD16	E meter	64 PM	\$4.85	
—	1	✓	✓	✓	—	✓	(3) SD16	E meter	64 PM	\$5.45	
—	1	✓	✓	✓	—	✓	(3) SD16	E meter	64 PM	\$5.95	
3	1	✓	✓	—	✓	✓	8-ch ADC12	—	80 PN, 100 PZ	\$4.45	
3	1	✓	✓	—	✓	✓	8-ch ADC12	—	80 PN, 100 PZ	\$4.70	
3	1	✓	✓	—	✓	✓	8-ch ADC12	—	80 PN, 100 PZ	\$4.90	
3	1	✓	✓	—	✓	✓	12-ch ADC12	(2) DAC12, (3) OPAMP	80 PN	\$6.50	
3	1	✓	✓	—	✓	✓	12-ch ADC12	(2) DAC12, (3) OPAMP	80 PN	\$7.35	
3	1	✓	✓	—	✓	✓	12-ch ADC12	(2) DAC12, (3) OPAMP	80 PN	\$7.95	
7	2	✓	✓	✓	✓	✓	8-ch ADC12	—	100 PZ	\$5.75	
7	2	✓	✓	✓	✓	✓	8-ch ADC12	—	100 PZ	\$6.50	
7	2	✓	✓	✓	✓	✓	8-ch ADC12	—	100 PZ	\$7.05	

## → TMS470 Microcontrollers: 32-Bit RISC ARM7TDMI®-Based

Building upon the success of its popular MCU products, TI—the largest, most experienced licensee of Advanced RISC Machines (ARM®) Ltd. cores—is now offering the TMS470 platform of microcontrollers to the mass market. Having gained extensive experience through its development in wireless, imaging and industrial markets, TI is a proven supplier of ARM core-based devices.

### Architecture

The TMS470 is derived from the 32-bit ARM7TDMI® core.\* This industry-standard architecture includes two instruction sets—32-bit instructions for fast execution and 16-bit instructions for high code density. It allows unlimited switching between instruction sets and also provides run-time decompression. This gives the designer ultimate flexibility when designing for high-speed operation or high-density code.

### Product Portfolio

The TMS470 microcontroller platform has devices ranging from 64 KB to 1 MB of Flash memory and a wide variety of intelligent peripherals including up to 32 timer channels, 16 channels of 10-bit analog-to-digital converters and a variety of communication interfaces.

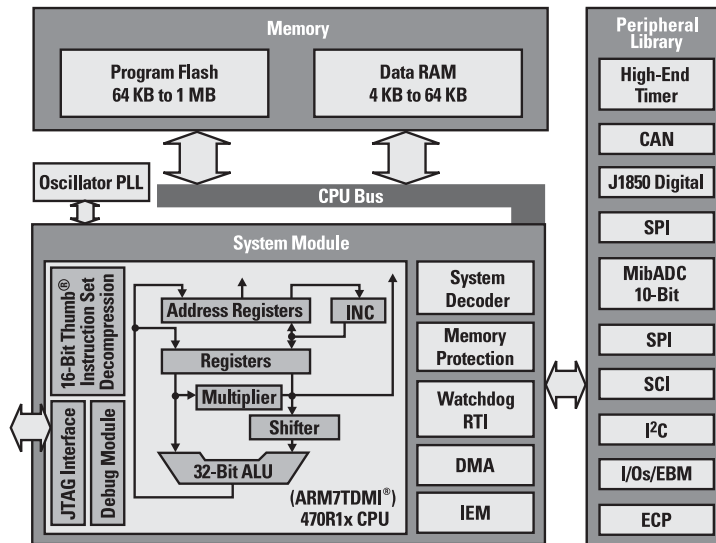
TMS470 microcontrollers are targeted for applications requiring the highest levels of performance and quality with the flexibility of a scalable architecture and a rich peripheral set. Typical applications include industrial systems, medical instrumentation, consumer electronics, data processing and many other general-purpose embedded applications.

TI's TMS470 ARM7TDMI-based MCUs bring you a complete microcontroller solution with quality, reliability and support.

\*T = Thumb® extension, D = Debug module, M = Multiplier and I = JTAG Interface.

### Key Benefits

- Reliability
  - Proven supplier of ARM® core-based devices
  - Used in safety-critical applications
- Performance
  - Up to 60 MHz
  - High-performance peripherals
- Integration
  - Wide offering of peripherals
  - Leading process technologies
- Scalability
  - Industry-standard architecture
  - Large portfolio of devices with Flash memory options from 64 KB to 1 MB
- Ease of Use
  - Easy-to-use tools speed time-to-market
  - Devices available today



### TMS470R1x Block Diagram

The TMS470R1x generation of MCUs utilizes the ARM7TDMI® core combined with intelligent peripherals and embedded memory to address a wide range of application needs.

### TMS470R1x Platform Selection Guide

Device	Package	Memory		Peripherals						I/O	Max Sys Clk (MHz)	Price*
		Flash (KB)	RAM (KB)	Timer†	ADC	SPI	SCI	CAN‡	Other			
TMS470R1A64	80 LQFP	64	4	13	8 ch, 10-bit	2	2	SCC	C2SI§	40	48	4.95
TMS470R1A128	100 LQFP	128	8	16	16 ch, 10-bit	2	2	SCC	C2SI§	50	48	5.95
TMS470R1A256	100 LQFP	256	12	16	16 ch, 10-bit	2	2	SCC	C2SI§	50	48	6.85
TMS470R1A288¶	100/144 LQFP	288	16	12	12 ch, 10-bit	2	2	2 x SCC	C2SI§, I²C, DMA, EBM#, MSM°	93	48	8.95
TMS470R1A512¶	144 LQFP	512	32	32	16 ch, 10-bit	3	2	2 x HECC	DMA	87	60	9.95
TMS470R1A768¶	144 LQFP	768	48	32	16 ch, 10-bit	5	2	3 x HECC	DMA	87	60	13.95
TMS470R1A1M¶	144 LQFP	1024	64	12	12 ch, 10-bit	2	3	2 x HECC	I²C, DMA, EBM#, MSM°	93	60	TBD

†The high-end timer (HET) is a programmable timer co-processor with up to 32 associated timing output pins for timer functions such as capture, compare, pulse width measurement and general-purpose I/O channels.

‡CAN 2.0B digital controller. Standard CAN controller (SCC) has 16 message mailboxes; high-end CAN controller (HECC) has 32 message mailboxes.

§C2SI = Class II Serial Interface.

¶Product preview. Available in 2005.

#EBM = Expansion Bus Module.

°MSM = Memory Security Module.

\* Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order.

**eXpressDSP™ Software and Development Tools****eXpressDSP Software and Development Tools**

Complete, Open, Real-Time Software Environment for TI DSPs

Get more information about eXpressDSP Software and Development Tools at: [www.dspvillage.com](http://www.dspvillage.com)**Standardization and Software Reuse Move DSP Development to a New Level**

- Standards enabled for modular, reusable multi-function applications
- Developers of all experience levels
- Integrate your own software
- Catalog of interoperable software
- Focus on adding value/differentiation
- Designed to cut development time by up to 50 percent and increase the modularity

**Tools and Standards to Simplify Application Development, Reduce System Cost, Enhance Product Robustness and Innovation and Accelerate Time-to-Market**

- Powerful, integrated development environment (Code Composer Studio™ Development Tools)
- Scalable real-time kernel (DSP/BIOS™ Kernel)
- eXpressDSP-compliant algorithms (written to the TMS320™ DSP Algorithm Standard)
- Reusable modular software and support from TI's DSP Third Party Network
- Available on TMS320C6000™, TMS320C5000™ and TMS320C2000™ DSP platforms
- Advanced data visualization and real-time analysis
- Powerful code generation tools
- Open plug-in architecture

**What are eXpressDSP Software and Development Tools?**

TI's real-time eXpressDSP Software and Development Tools provide a complete and open DSP software environment to simplify and streamline the DSP product development process. It provides access to a large number of reusable software components, host tooling (Code

Composer Studio™ Development Tools) and target-side content (eXpressDSP-compliant algorithms and DSP/BIOS™ kernel) to reduce development time. For information on eXpressDSP Software and Development Tools, visit [www.dspvillage.com](http://www.dspvillage.com)

**Code Composer Studio Development Tools**

- Comprehensive IDE includes tools for editing, debugging, compiling, code profiling and more
- Free evaluation tools available
- Sophisticated project manager enables team-based development
- Fast simulators provide deeper visibility for quick and precise problem resolution
- Analysis tools boost performance and simplify tedious tasks
- Advanced Code Tuning tools take weeks out of the optimization process

**XDS560™ Emulator**

- Real-time JTAG-based emulator supporting high-speed RTDX™-enabled devices
- Speeds time-to-market with real-time data transfer rates of over 2 MBytes/second
- Increases productivity with faster start up for larger applications
- Quickly finds and fixes intermittent real-time problems
- Upward compatible with XDS510™ Emulators

**eXpressDSP Software****eXpressDSP Reference Frameworks**

- Get started today – out-of-the-box framework software
- Adaptable to your needs – 100 percent C-source code
- Pick version just right for you – available for different applications
- Reduces cost – royalty-free run-time licensing (RF1, RF3, RF5 and RF6)
- Saves time – eliminates design, build and test of low-level parts of DSP solution

**eXpressDSP DSP/BIOS Kernel**

- No run-time royalty – free with Code Composer Studio Development Tools
- Integrated with Code Composer Studio Development Tools
- Includes preemptive multitasking scheduler and real-time analysis

**eXpressDSP-Compliant Algorithms**

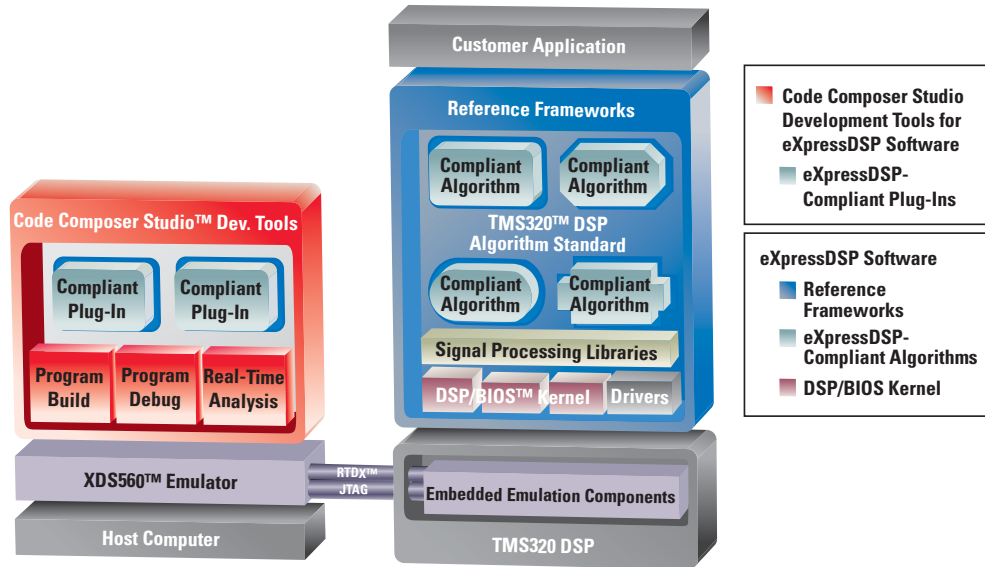
- Available for a myriad of applications
- Written to the TMS320™ DSP Algorithm Standard

**TI DSP Third Party Network**

- Get started now and focus on differentiating your product. Over 700 third parties offer hundreds of compliant algorithms, hardware boards, emulators and more
- More than 1,000 eXpressDSP-compliant algorithms and plug-ins available today



## eXpressDSP™ Software and Development Tools



### eXpressDSP Software and Development Tools Block Diagram

eXpressDSP Software Development Tools for faster programming and easier integration.

## eXpressDSP Reference Frameworks

*Getting Started Software for DSP-Based Application Development Increases Productivity and Speeds Time-to-Market with Differentiated Products*

Accelerating the software development process for designers of DSP-based applications, TI produces and supports a series of DSP software Reference Frameworks (RF). The design-ready RFs are getting-started solutions for

designers in the early stages of application development, featuring easy-to-use source code that is common to many applications. With TI's RFs, much of the initial low-level design decisions have been eliminated allowing developers more time to focus on the code that truly differentiates products. Designers can choose the specific RF that best meets their system needs and then populate the

RF with algorithms from either the 1,000 eXpressDSP-compliant algorithms or their own algorithms, creating specific applications for a range of end-equipments such as broadband, voice, video imaging, biometrics and wireless infrastructure.

For more information, visit [www.ti.com/rfinfo](http://www.ti.com/rfinfo)

Design Parameter		Compact	Flexible	Extensive	Connected
Absolute minimum footprint		Yes	–	–	–
Static configuration		Yes	Yes	Yes	Yes
Static memory management		Yes	Yes	Yes	Yes
Single-rate operation		Yes	Yes	Yes	Yes
Number of channels		1 to 3	1 to 10+	1 to 100+	1 to 100+
Number of eXpressDSP algorithms		1 to 3	1 to 10+	1 to 100+	1 to 100+
Dynamic memory allocation		–	Yes	Yes	Yes
Multi-rate operation		–	Yes	Yes	Yes
Implements control functionality		–	Yes	Yes	Yes
Thread preemption		–	Yes	Yes	Yes
Thread suspension (semaphores)		–	–	Yes	Yes
Dynamic object creation		–	–	Yes	Yes
Implements DSP–GPP functionality		–	–	–	Yes
Memory footprint (less algorithms)	C54x™	3.5 kw	11 kw	–	–
	C55x™	5 kw	12 kw	17 kw	25 kw
	C64x™	–	–	54 kB	–
Name of Reference Framework		RF1	RF3	RF5	RF6
Availability		Now	Now	Now	Now

## Code Composer Studio™ Development Tools for eXpressDSP™ Software



## Code Composer Studio Software Development Tools

Integrated Development Environment

Get more information about Code Composer Studio Development Tools at: [www.ti.com/ccstudio](http://www.ti.com/ccstudio)

## Code Composer Studio Development Tools Simplify DSP Development

Code Composer Studio (CCStudio) software is a fully integrated development environment (IDE) supporting Texas Instruments industry-leading TMS320C6000™, TMS320C5000™, TMS320C2000™ DSP and OMAP™ processor platforms. CCStudio IDE is a key component of eXpressDSP™ Software and Development Tools that slashes development and integration time for DSP software.

## Features and Benefits

- Unified IDE supports C2000™, C5000™, C6000™ DSP and OMAP processor platforms in one installation providing development tool savings, multiprocessor support and ease of platform migration
- Real-time analysis tools for monitoring program interactions without halting the processor
- A scalable real-time kernel (DSP/BIOS™ kernel)
- Advanced Code Tuning tools streamline optimization process to meet power/performance and code size goals
- Data visualization for viewing signals in multiple graphical formats
- Real-time JTAG scan-based emulation for TI DSPs with the XDS560™ and XDS510™ Emulators
- Easily manage large multi-user, multi-site and multi-processor projects
- Fast simulators provide deeper visibility for quick and precise problem resolution
- Integrated CodeWright editor provides quick startup and many time saving features
- Component Manager offers flexibility to evaluate or lock down compiler and DSP/BIOS versions for the life of the project
- Advanced back-stepping debug features and robust host-to-target connections eliminate tons of stress during debug

## Code Composer Studio Development Tools Overview

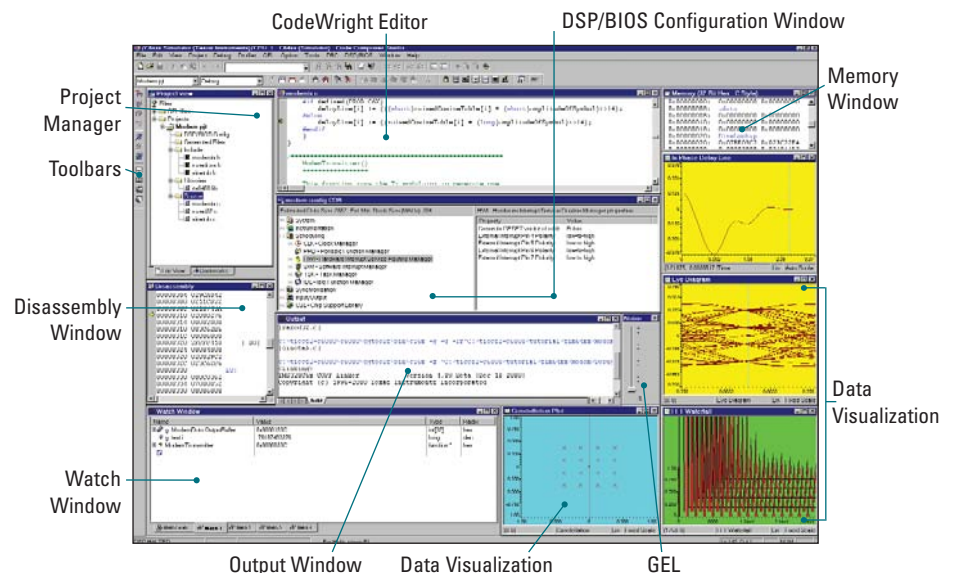
Code Composer Studio IDE includes the features necessary to take you through each step of the application development flow. All of the features are provided in an integrated product allowing developers to focus their energy on innovation. Code Composer Studio IDE has an open architecture that allows TI and third parties to extend the IDE's functionality by seamlessly plugging in additional specialized tools. Such familiar tools and interfaces allow users to get started faster than ever before and add functionality to their application thanks to sophisticated productivity tools.

Code Composer Studio full-function evaluation tools are available for a free 120-day evaluation. To order your CD-ROM, visit [www.ti.com/freetools](http://www.ti.com/freetools)

## Industry-Leading C/C++ Compiler

Unlike other compilers that rely on public domain (GNU) technology, TI's Code Composer Studio compiler takes advantage of limited registers and makes tight DSP-specific loops. With more than 20 years experience and several patents, the robust and reliable compiler and optimizer technologies allow developers to spend less time hand-coding and more time concentrating on delivering new applications.

Code Composer Studio tools include the only compiler that optimizes code at the program level, which is often critical to performance. The compiler also contains many DSP-specific optimizations, such as software pipelining, conversion/predicate execution, memory address cloning and memory address dependence elimination.



Code Composer Studio Development Tools feature all tools used in the development cycle working tightly together. Edit, build, debug and visualize.



## Code Composer Studio™ Development Tools for eXpressDSP™ Software

### Tuning Tools

Advanced tools designed specifically for the optimization process 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 tuning process specific to the goals set by the developer.

### Debug Within the IDE

Code Composer Studio IDE's integrated debugger has DSP-specific capabilities and advanced breakpoints to simplify development. Conditional or hardware breakpoints are based on full C

expressions, local variables or CPU register symbols. A General Extension Language (GEL) script file can be executed when a particular breakpoint hits. Global breakpoints are also available for multiprocessor systems. Developers can debug code quickly by selectively stepping into, over or out of C function or assembly subroutines. CCStudio's Debug Rewind capability lets users also step backwards in their source code to quickly find and observe application behavior during a simulation. A ProbePoint™, unique to Code Composer Studio Development Tools, is a sophisticated form of a break-

point. It allows developers to define a point in the algorithm where oscilloscope-type functions can be performed. Unlike a breakpoint, program execution resumes after hitting a ProbePoint and performs the connected activity (e.g., inject or extract signal data, observe signals, execute GEL script). CCStudio IDE also supports popular external scripting languages such as Perl and VBA to help developers automate application testing and validation.

### Multi-Target Debug

Code Composer Studio IDE supports the development of complex systems with

## Code Composer Studio Development Tools Features Supported by Platform

Feature	Code Composer Studio IDE Platinum											
	C6000™ DSP				C5000™ DSP		OMAP™ Processors				C2000™ Controllers	
	C62x™	C64x™	C67x™	DM64x™	C54x™	C55x™	C54x	C55x	ARM7	ARM9	C24x™	C28x™
<b>Application Design</b>												
DSP/BIOS™ Kernel	X	X	X	X	X	X	X	X				X
TMS320™ DSP Algorithm Std.	X	X	X	X	X	X	X	X			X	X
Reference Frameworks†	X	X	X	X	X	X	X	X				
Chip Support Library	X	X	X	X	X	X	X	X				
Data Converter Selector Plugin†	X	X	X	X	X	X	X	X			X	X
Driver Development Kit†	X	X	X	X	X	X	X	X				X
Update Advisor	X	X	X	X	X	X	X	X	X	X	X	X
<b>Code &amp; Build</b>												
CCStudio Point and Click IDE	X	X	X	X	X	X	X	X	X	X	X	X
C/C++ and Assembly Language Tools	X	X	X	X	X	X	X	X	X	X	X*	X
CodeWright Integrated Editor	X	X	X	X	X	X	X	X	X	X	X	X
Online Help	X	X	X	X	X	X	X	X	X	X	X	X
Project Manager	X	X	X	X	X	X	X	X	X	X	X	X
<b>Debug</b>												
RTDX™	X	X <sup>¶</sup>	X	X <sup>¶</sup>	X	X	X	X				X
Fast Simulation	X	X	X	X		X		X				
Simulators	X	X	X	X	X	X	X	X	X	X		X
Watch Windows	X	X	X	X	X	X	X	X	X	X	X	X
GEL Scripting (internal)	X	X	X	X	X	X	X	X	X	X	X	X
Perl/VBA Scripting† (external)	X	X	X	X	X	X	X	X	X	X	X	X
Parallel Debug Manager	X	X	X	X	X	X	X	X	X	X	X°	X°
Connect/Disconnect	X	X	X	X		X		X	X	X		X
Flashburn Utility†	X	X	X	X	X	X	X	X	X	X		
Advance Event Triggering		X		X		X		X				
Code Coverage	X	X	X	X		X		X				
<b>Analyze &amp; Tune</b>												
Pipeline Analysis						X		X				X
Rewind						X		X				
Tuning Dashboard and Profiler	X	X	X	X	X	X <sup>§</sup>	X	X <sup>§</sup>	X	X	X	X
Compiler Consultant	X	X	X	X								
CodeSizeTune‡	X	X	X	X								
Cache Tune	X	X	X	X		X		X				

\* C and ASM support only

§ Includes power management advice

° Supports only homogeneous multi-processing

† Available through Update Advisor for users with active CCStudio IDE subscription

¶ HSRTDX available

‡ Formerly called Profile-Based Compiler

## Code Composer Studio™ Development Tools for eXpressDSP™ Software



multiple boards or multiple processors on a single target board. Code Composer Studio's Parallel Debug Manager (PDM) provides synchronized control over multiple processors configured in single or multiple scan chains. It can be used to launch individual parent windows to control each processor. The Parallel Debug Manager can be used to broadcast commands to different groups of CPUs in the JTAG scan path. A global breakpoint command on one processor can halt other processors when this breakpoint is encountered. The Parallel Debug Manager lets developers open up separate debug windows for any CPU on any board in the system. CCStudio's unified IDE supports TMS320C2000™, TMS320C5000™, TMS320C6000™ DSP and OMAP™ processor platforms in one simple installation enabling a variety of configurations such as multiple DSP, heterogeneous DSP combinations, SOC and discreet DSP/Microcontroller groupings.

### Real-Time Data Exchange (RTDX™)

Once algorithms are integrated into applications, the real-time behavior of the system must be observed. Code Composer Studio Development Tools allow the developer to visualize or debug

an application while it runs in real time. Real-Time Data Exchange provides significant benefits over alternative methods of system debugging.

RTDX gives developers the industry's first DSP system that provides real-time, continuous visibility into the way target applications operate in the real world. RTDX allows developers to transfer data between the host computer and DSP devices without stopping their target application. This shortens development time by giving developers a much more realistic representation of the way their systems operate. RTDX allows designers to continually monitor their systems and gain real-time insight into their running applications.

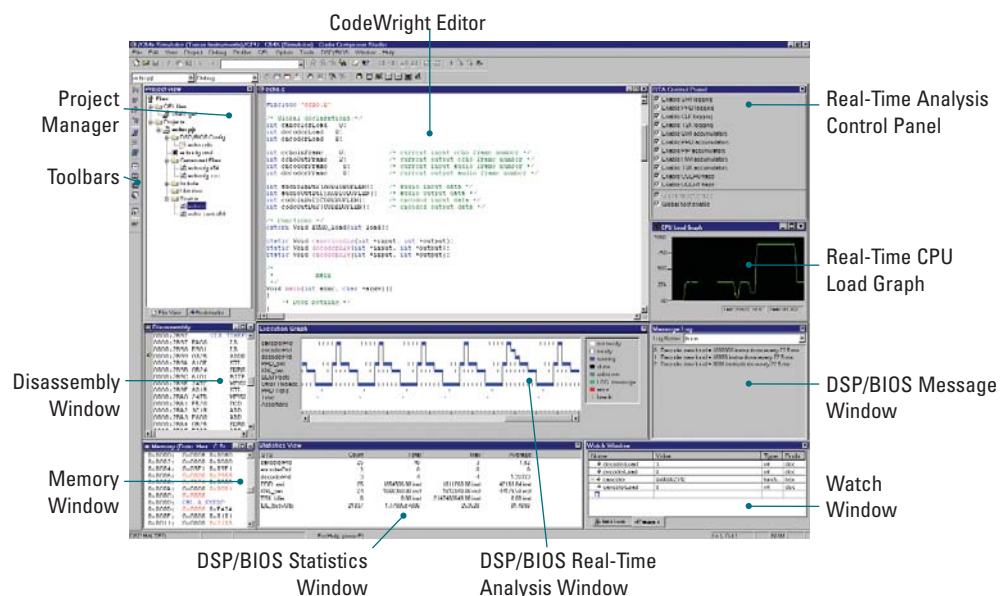
### Interactive Profiling

Code Composer Studio IDE's interactive profiler makes it easy to quickly measure code performance and ensure the efficient use of the DSP target's resources during debug and development sessions. The profiler allows developers to easily profile all C/C++ functions in their application for instruction cycles or other events such as cache misses/hits, pipeline stalls and branches. Profile

ranges can be used to concentrate efforts on high-usage areas of code during optimization, helping developers produce finely-tuned code. Profiling is available for ranges of Assembly, C++ or C code in any combination. To increase productivity, all profiling facilities are available throughout the development cycle.

### Real-Time Analysis

Using the real-time analysis capabilities of Code Composer Studio Development Tools, a developer can probe, trace and monitor a DSP application while it runs. These utilities are based on a real-time link and awareness between the Code Composer Studio Development Tools host environment and the target. Even after the program has been halted, information already captured through the real-time analysis tools can provide invaluable insight into the sequence of events that led up to the current point of execution. Real-time analysis tools are used later in the development cycle when transitioning from the debug phase to the runtime phase. They show subtle problems arising from time-dependent interaction of program components. Real-time analysis tools are the software counterpart of the hardware logic analyzer.



Code Composer Studio full-function evaluation tools are available for a free 120-day evaluation. To order your CD-ROM, visit [www.ti.com/freetools](http://www.ti.com/freetools)

*DSP/BIOS™ configuration and real-time analysis tools are included and are fully integrated with Code Composer Studio IDE.*



## DSP/BIOS™ Kernel for eXpressDSP™ Software

### DSP/BIOS Kernel

Scalable Real-Time Kernel

Get more information about DSP/BIOS Real-Time Kernel at: [www.ti.com/dspbios](http://www.ti.com/dspbios)

#### DSP/BIOS Kernel Shortens Development Time

DSP/BIOS kernel is a scalable real-time kernel, designed for the TMS320C28x™ DSP generation, TMS320C5000™ and TMS320C6000™ DSP platforms with preemptive multithreading, hardware abstraction, real-time analysis and system configuration tools.

#### Features and Benefits

- Quickly design multifunction applications
- Understand your application's real-time behavior
- No need to develop scheduling software
- Simpler device configuration and programming
- Port applications quickly to new devices
- Preemptive multitasking scheduler
- Multiple scheduling and communication mechanisms
- Fast, deterministic performance
- Very small memory footprint
- Configurable functionality
- Static and dynamic task creation
- Integrated real-time analysis tools
  - CPU load
  - Max/Average execution times
  - Task execution trace
  - Kernel object browser

#### DSP/BIOS Kernel Overview

DSP/BIOS kernel simplifies the development of today's multifunction DSP applications. Complex applications that are easily organized into separate threads are scheduled in real-time according to their priority. New functionality can be easily added without affecting the response time of critical real-time functions. DSP/BIOS kernel also provides a set of interthread communication mechanisms that enable synchronization between threads if desired.

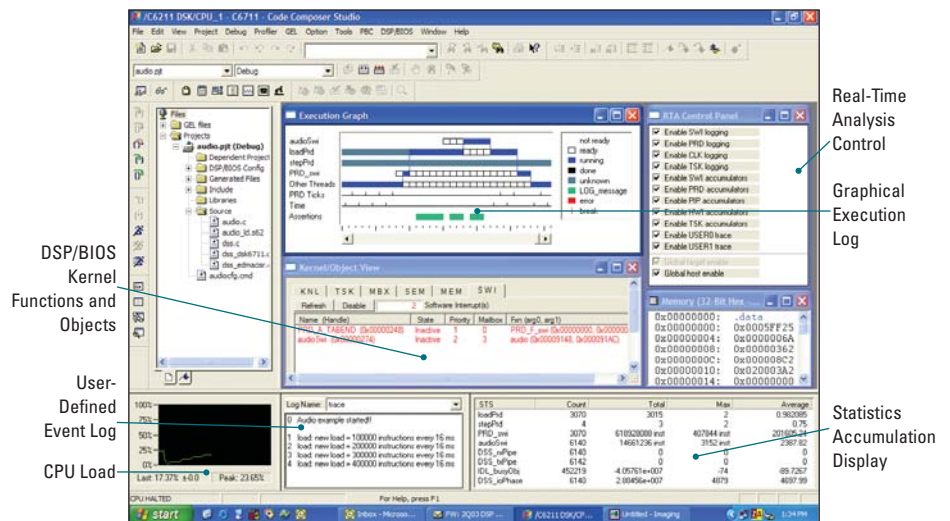
To aid debugging of complex applications, DSP/BIOS kernel includes host-to-target communication and real-time instrumentation services that are integrated with graphical real-time analysis displays on the development host. DSP programmers can instrument their applications to be probed, traced and

monitored as they execute in real-time. Alternatively, programs that take advantage of the multithreading capabilities of the DSP/BIOS kernel are implicitly instrumented; i.e., programs without any explicit calls to the DSP/BIOS kernel APIs can be traced in real-time.

DSP/BIOS kernel is integrated within the Code Composer Studio™ Development Tools, requires no run-time license fees and is fully supported by Texas Instruments.

DSP/BIOS kernel gives you a solid foundation to support substantial, sophisticated programs with a robust, industry-proven software kernel that has been used in thousands of designs.

For more information, visit [www.ti.com/dspbios](http://www.ti.com/dspbios)



Find and fix real-time problems without any runtime license fees.

# TMS320™ DSP Algorithm Standard for eXpressDSP™ Software



## TMS320 DSP Algorithm Standard

Standards for Application Interoperability

Get more information on the TMS320 DSP Algorithm Standard at: [www.ti.com/algostanddevkit](http://www.ti.com/algostanddevkit)

### Features and Benefits

- 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
- Rules for TMS320C2000™, TMS320C5000™ and TMS320C6000™ DSP platforms
- Tools included to help create compliant algorithms, test for compliant algorithms and optimize algorithms for compact systems

### Mandatory Rules

- The standard consists of the following:
  - 46 basic “common sense” rules for all algorithms
  - IALG APIs – Abstracts DSP memory management away from algorithms
  - IDMA2 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
- Methods for extending baseline APIs for added functionality – allowing for differentiation

### eXpressDSP™ Compliance

- Hundreds of algorithms tested to comply to the TMS320 DSP Algorithm Standard

## TMS320 DSP Algorithm Standard Overview

The TMS320 DSP Algorithm Standard is a key ingredient of eXpressDSP™ Technology. The standard is a set of coding conventions for algorithm writers that ultimately eliminate much of the time-consuming reengineering 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.

The TMS320 Algorithm Standard documentation, header files and examples are included in Code Composer Studio™ IDE.

### Creating eXpressDSP-Compliant Algorithms

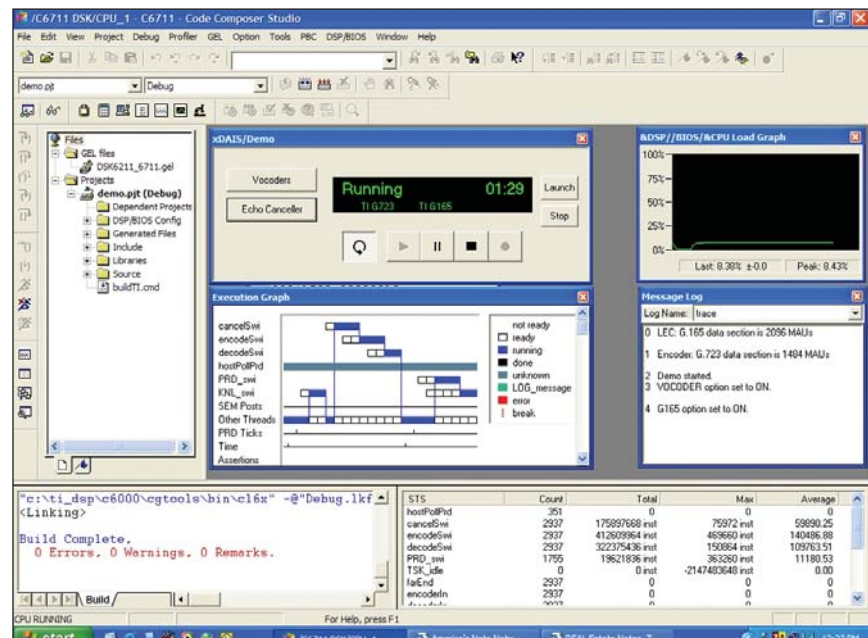
The Hyperception Component wizard included in CCStudio provides step-by-step guidance to prevent users from using non-conforming entries. Upon completion, verify compliance with the standard by using the automated test tool – QualiTI.

### Using eXpressDSP-Compliant Algorithms

To browse and purchase off-the-shelf production-ready algorithms, visit TI's website to view a list of companies that have produced eXpressDSP-compliant algorithms. Go to the DSP Developer's Village and follow the links in the eXpressDSP compliance program box and look for the compliance logo.



For more information about the TMS320 DSP Algorithm Standard Developer's Kit visit [www.ti.com/algostanddevkit](http://www.ti.com/algostanddevkit).



The TMS320 DSP Algorithm Standard Developer's Kit demo shows how easily eXpressDSP-compliant algorithms interoperate.



## JTAG Emulator with High-Speed Real-Time Data Link

### XDS560™ JTAG Emulator

JTAG Emulator Supporting RTDX™ Data Link

Get more information about the XDS560 Emulator at: [www.ti.com/emulator](http://www.ti.com/emulator)

#### Features and Benefits

- **Speed time-to-market with real-time visibility** – High-speed RTDX with real-time data transfer rates of more than 2 MBytes/second
- **Increase productivity through faster start up for larger applications** – Code download speeds of up to more than half a MByte/second
- **Quickly find and fix intermittent real-time problems** – Real-time, non-intrusive breakpoint and action point capabilities via Advanced Event Triggering
- **Preserve existing emulation investment** – Upward compatible with XDS510™ Emulators

### JTAG Emulator with High-Speed Real-Time Data Exchange (RTDX): XDS560 Emulator

The XDS560 JTAG Emulator provides an unparalleled level of real-time visibility into executing applications to assist developers in debugging and monitoring real-time systems. High-speed RTDX bandwidth enables visibility into a new range of high-bandwidth applications, as well as multi-channel or multiprocessing versions of lower-bandwidth applications. The XDS560 Emulator can achieve code download speeds of up to more than half a megabyte per second (500 KBytes per second), as much as 8 times faster than XDS510™-class technology, for better loading times of larger applications, speeding development. The XDS560 Emulator also enables Advanced Event Triggering to define and evaluate complex sequences of events before halting the CPU, or taking another action, including:

- Setting hardware breakpoints and watchpoints
- Counting many kinds of events
- Detecting very precise debugging sequences

The XDS560 Emulator is fully upward compatible with TI's existing XDS510 Emulator. XDS510-class Emulator customers can move from the XDS510 Emulator to using the XDS560 Emulator with very little apparent change, using the same target boards with the existing 14-pin JTAG connectors. The XDS560 Emulator features are a superset of the XDS510 Emulator, but include all of the same XDS510-class functions that TI developers expect, with significantly improved performance.

The XDS560 Emulator is available in Ethernet, PCI and USB interfaces offering high performance and ample bandwidth to support high-speed RTDX data rates. It includes a longer and highly flexible 5-1/2 foot (1.5+ m) host-target cable suitable for use from 5 V down to 0.5 V to support TI's low-voltage device roadmap.



*XDS560 Emulator with highly flexible cable and credit card-sized pod is available in the eStore.*

The XDS560 Emulator is based on TI's TMS320C6202 DSP, for additional processing power to help drive the improved performance. It is well suited for space-constrained environments, as the cable can reach into tight places between rack-mounted target boards, and the cable/pod assembly is so light it can even hang from the 14-pin JTAG connector without straining it.

For more information on the XDS560 Emulator, visit [www.ti.com/emulator](http://www.ti.com/emulator)

XDS560-class JTAG Emulator products are also available from many TI third parties featuring different communication interfaces such as Ethernet and USB, as well as other features. See the TI DSP Village Third Party on-line catalog and search for "XDS560."



T1 Part Number	Tool Description	Annual Subscription	Code Composer Studio IDE	DSP BIOS™ Real-Time Operating System/Services	TMS320™ DSP Algorithm Standard Developer's Kit	Code Generation Tools C/C++ Compiler/Assembler/Linker	XDS300™ Device Drivers (Emulation software)	XDS300™ Device Drivers (Emulation software)	RTOS™ (Emulation software)	Simulator	Target Board (Hardware)	Target-Specific Device Drivers	Price U.S.*
TMDSCCSALL-1	Code Composer Studio™ Development Tools Platinum Edition	X	X	X	X	X	X	X	X	X			3,595
TMDSDSK6713	C6713 DSP Starter Kit (DSK)		X†	X	X	X	X	X	X	X†	X	X	395
TMDXDSDK6416-T	C6416 DSP Starter Kit (DSK)		X†	X	X	X	X	X	X	X†	X	X	495
TMDSEVM642	TMS320DM642 Evaluation Module										X		1,995
TMDSDMK642	TMS320DM642 Digital Media Development Kit	X	X	X	X	X	X	X	X	X	X	X	6,495
TMDXNVK6415-T	C64x™ DSP Network Video Developer's Kit										X		4,495
TMDXVSK642	Video Security over Internet Protocol (VSIP) Development Platform	X	X	X	X	X	X	X	X	X	X	X	15,000
TMDXVSK642-3	VSIP Development Platform with ATEME Emulator	X	X	X	X	X	X	X	X	X	X	X	16,000
TMDSDVP64X-2	Videophone Development Kit (VDP)										X	X	6,950
TMDX3PNV6416S	Network and Video Development Kit										X	X	4,495
TMDXNVK6415-T	Network and Video 1-GHz Development Kit										X	X	4,495
TMDSFDCPPC10	Fingerprint Authentication Development Tool										X	X	245
SPRC119C	Essential Guide to Getting Started with DSP CD-ROM†		L	X	L	X	X	L	L	L			Free
TMDSHFK5407	Hands-Free Kit (HFK) Development Platform										X	X	1,495
TMDSDSK5416	C54x™ DSP Starter Kit (DSK)		X†	X	X†	X	X	X	X	X	X	X	395
TMDSDSK5510	C55x™ DSP Starter Kit (DSK)		X†	X	X†	X	X	X	X	X	X	X	395
TMDSOSK5912	OMAP5912 Starter Kit (OSK)										X	X	295
TMDSKSP5912-L	OMAP™ Starter Kit with Logic PD Kickstart Program	X	X	X	X	X	X	X	X	X	X	X	7,200
TMDSKSP5912-M	OMAP Starter Kit with Mistral Kickstart Program	X	X	X	X	X	X	X	X	X	X	X	7,200
TMDS3P701016A	LF2407A Evaluation Module (EVM)*		X		X					X	X	X	1,995
TMDSEZD2407	LF2407A eZdsp™ Starter Kit*		X†		X						X	X	345
TMDSEZD2401	LF2401A eZdsp Starter Kit*		X†		X						X	X	595
TMDSEZD2812	F2812 eZdsp Starter Kit*		X†	X	X				X	X	X	X	395
TMDSEZS2812	F2812 eZdsp Starter Kit (Socketed)		X†	X	X				X	X	X	X	495
TMDXESZ2808	F2808 eZdsp Starter Kit (Socketed)		X†	X	X				X	X	X	X	495
TMDSEVP2812	F2812 Development Bundle (Parallel Port)		X	X	X				X	X	X	X	1,995
TMDSEVU2812	F2812 Development Bundle (USB)		X	X	X				X	X	X	X	2,295
TMDSCCS2000-1	C2000™ DSP Code Composer Studio Development Tools	X	X	X	X	X	X	X	X	X			495
TMDSEMU560	XDS560™ PCI-Bus High-Performance JTAG Emulator										X	X	3,995
TMDSEMU560U	XDS560™ Blackhawk USB High-Performance Emulator										X	X	2,995
TMDSEMUPP	XDS510PP-Plus (Parallel Port) Emulator										X	X	1,500
TMDSEMUUSB	XDS510™ USB-Based Emulator for Windows										X	X	1,995

X = included L = Full featured - Limited to 120 days \* Codeveloped with Spectrum Digital. † DSK must be connected for Code Composer Studio to run. ‡ Available only in Texas Instruments eStore. § Includes 120-day free evaluation tools.  
 † ARM code generation tools only.  
 + Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing. All prices are subject to change. Customers are advised to obtain the most current and complete pricing information from TI prior to placing orders. TI may verify final pricing prior to accepting any order.



## TI DSP Third Party Network

### A Wide Variety of DSP Solutions

Utilize the TI Third Party Network for:

- **Complete solutions** – Third-party companies offer complete solutions for quickly solving application problems. Many solutions incorporate TI's data converters and power management devices.
- **Reduced time-to-market** – Time-consuming programming and troubleshooting tasks can be eliminated by utilizing proven hardware, software, algorithms and libraries from third parties.
- **Lower costs** – Don't spend time and money recreating something that has already been produced. Third parties allow you to dedicate your resources to producing value-added, application-specific products.
- **Additional expertise** – Third-party companies provide consulting services, training, integration, contract engineering, research and development and much more. They are an extra resource for project assistance.

### eXpressDSP™-Compliant Third-Party Products

Texas Instruments in conjunction with its industry-leading DSP Third Party Network offer an array of eXpressDSP-compliant algorithms designed to reduce system integration time and lower support and development costs by eliminating custom coding tasks. Third parties also provide eXpressDSP-compliant plug-in tools to reduce development time. For a complete listing of algorithms and plug-ins, visit [www.ti.com/algorithms](http://www.ti.com/algorithms)

## 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. Products/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.

### Video/Imaging and Audio

- Compression software
- Research and development support
- Hardware and reference designs
- Enhancement libraries
- Print head control software

### Comprehensive Development Support

- DSP boards, starter kits and add-ons
- Customized debuggers
- Targeted development platforms
- Real-time emulation
- Consulting services
- Simulation models

### Third Party Product Catalog on TI's Website

For information regarding the vast array of products available from TI's Third Party Network, check out: [www.ti.com/thirdpartycatalog](http://www.ti.com/thirdpartycatalog). Extensive information can be found through searchable listings of worldwide TI third parties. Search hundreds of listings by company, device supported, keyword, product name or product category.

### Third Party Network Logo Indicates TMS320™ DSP-Based Solution

Registered TI Third Party Network members use a distinctive Third Party Network logo on various printed and electronic collateral. Look for the logo to identify companies that are ready to provide a TMS320 DSP-based solution.



### eXpressDSP-Compliant Logo Indicates TMS320 DSP Algorithm Standard Compliance

Third Party Network members use the eXpressDSP compliance logo in various communications. The logo identifies companies ready to provide products that have passed the standards for application interoperability and reuse.



### Getting Started with DSP

- On-site customized training
- Contract engineering design resources
- Subsystem development
- Software experts in applications: embedded control, set-top box, optical networking, digital radio, telematics, biometrics

### Communications

- Modem and DSL software
- Encryption software
- Voice and fax software
- Wireless software
- Real-time operating systems (RTOS)
- Hardware and reference designs
- Consultants

### DSP Solutions to Reduce Development Time



## Third Parties Providing eXpressDSP™-Compliant Algorithms

Get the most updated information on eXpressDSP-compliant algorithms at: [www.ti.com/algorithms](http://www.ti.com/algorithms)

### What are eXpressDSP-Compliant Algorithms?

eXpressDSP-compliant algorithms adhere to the rules set forth in TI's TMS320™ DSP Algorithm Standard. Each algorithm is passed through a rigorous automated test before receiving the right to be described as compliant. Pages 65–72 list many of the currently available compliant algorithms and plug-ins from TI third parties.

TI's extensive Third Party Network includes companies that develop eXpressDSP-compliant algorithms based on the TMS320 DSP Algorithm Standard. These algorithm developers provide both proprietary solutions and software that adheres to organizational standards for an array of applications. Our third parties offer

eXpressDSP-compliant solutions for Audio, Digital Motor Control (DMC), Fax, Protocol Stacks, Security, Speech, Telephony, Voiceband (VB) Modems, Video & Imaging, Vocoders and Wireless applications across the TMS320C2000™, TMS320C5000™ and TMS320C6000™ DSP platforms.

For more information on compliant algorithms offered by our TI DSP Third Parties, please access the on-line TI DSP Third Party Catalog at [www.ti.com/algorithms](http://www.ti.com/algorithms). You can also send an e-mail to [3pquery@list.ti.com](mailto:3pquery@list.ti.com) to inquire about any eXpressDSP-compliant algorithms you may be interested in.

Third Party	3P Website	TI DSP Device			Application											
		C2000™	C5000™	C6000™	Audio	DMC	Fax	Protocol Stacks	Security	Speech	Telephony	VB Modems	Video & Imaging	Vocoders	Wireless	
Acoustic Technologies, Inc.	<a href="http://www.acoustictech.com">www.acoustictech.com</a>	X		X							X					
Adaptive Digital Technologies, Inc.	<a href="http://www.adt-inc.com">www.adt-inc.com</a>		X								X				X	
Advanced Recognition Technologies, Inc.	<a href="http://www.artcomp.com">www.artcomp.com</a>		X							X						
Alango	<a href="http://www.alango.com/">www.alango.com/</a>		X		X											
Aliph Com	<a href="http://www.aliph.com">www.aliph.com</a>		X		X											
ATEME	<a href="http://www.ateme.fr">www.ateme.fr</a>		X	X	X								X			
Bayer DSP	<a href="http://www.dsp-bayer.com">www.dsp-bayer.com</a>		X					X			X					X
Clarity, LLC	<a href="http://www.clarityco.com">www.clarityco.com</a>		X							X						
Commetrex Corp.	<a href="http://www.commetrex.com">www.commetrex.com</a>		X	X				X			X				X	
Creative DSP Solutions, Inc.	<a href="http://www.creativedsp.com">www.creativedsp.com</a>		X		X											
CuTe Solutions	<a href="http://www.cutesolinc.com/">www.cutesolinc.com/</a>			X	X											
Cybernetics Infotech	<a href="http://www.cybit.com">www.cybit.com</a>		X												X	
D2 Technologies, Inc.	<a href="http://www.d2tech.com">www.d2tech.com</a>		X								X				X	
D+R Electronika B.V.	<a href="http://www.d-r.nl">www.d-r.nl</a>			X	X											
DACS Software Pvt. Ltd.	<a href="http://www.dacsindia.com">www.dacsindia.com</a>		X								X					
Dilithium Networks	<a href="http://www.dilithiumnetworks.com">www.dilithiumnetworks.com</a>			X	X							X				
DSP Wizard	<a href="http://www.dspwizard.com">www.dspwizard.com</a>		X												X	
DSPepecialists GmbH	<a href="http://www.dspepecialists.de">www.dspepecialists.de</a>		X	X	X											
easytools s.l.	<a href="http://www.easytools.es">www.easytools.es</a>		X						X							
Emuzed, Inc.	<a href="http://www.emuzed.com">www.emuzed.com</a>		X	X									X			X
Encore Software Ltd.	<a href="http://www.ncoretech.com">www.ncoretech.com</a>		X	X											X	
Enounce, Inc.	<a href="http://www.enounce.com">www.enounce.com</a>		X		X											
eSecurium	<a href="http://www.esecurium.com">www.esecurium.com</a>		X						X							
Ethentica by Security First Corp.	<a href="http://www.ethentica.com">www.ethentica.com</a>		X						X				X			
Fonix Corp.	<a href="http://www.fonix.com">www.fonix.com</a>		X							X						
Fraunhofer IIS	<a href="http://www.iis.fhg.de">www.iis.fhg.de</a>			X	X											
GAO Research, Inc.	<a href="http://www.gaoresearch.com">www.gaoresearch.com</a>	X							X	X	X		X			
Global IP Sound AB	<a href="http://www.globalipsound.com">www.globalipsound.com</a>	X													X	
HelloSoft, Inc.	<a href="http://www.hellosoft.com">www.hellosoft.com</a>		X								X				X	X
IdenCom	<a href="http://www.idencom.com/">www.idencom.com/</a>			X					X				X			
IdentAlink	<a href="http://www.identalink.de/">www.identalink.de/</a>			X					X				X			
ILLICO	<a href="http://www.illico.com">www.illico.com</a>		X	X				X				X				
Ingenient Technologies, Inc.	<a href="http://www.ingenient.com">www.ingenient.com</a>		X	X	X				X	X	X		X	X		
Ittiam Systems Private Limited	<a href="http://www.ittiam.com">www.ittiam.com</a>		X	X	X					X			X	X		



## → Third Parties Providing eXpressDSP™-Compliant Algorithms

Third Party	3P Website	TI DSP Device			Application										
		C2000™	C5000™	C6000™	Audio	DMC	Fax	Protocol Stacks	Security	Speech	Telephony	VB Modems	Video & Imaging	Vocoders	Wireless
Mango DSP, Ltd.	www.mangodsp.com			X									X		
Mecoso Technology, Inc.	www.mecoso.com			X									X		
MESi	www.mesi.net		X					X			X	X			
Motorola (BlueWave Systems)	www.bluewv.com			X						X				X	
National Instruments / Hyperception	www.ni.com	X	X							X			X		
Netbricks	www.netbricks.net/		X								X				
NeuroDynamics, Ltd.	www.neurodynamics.com	X							X			X			
NeuVoice	www.neuvoice.com		X							X					
Noise Cancellation Technology (NCT)	www.nctclearspeech.com/		X					X							
NTRU Cryptosystems, Inc.	www.ntru.com		X						X						
Octiv, Inc.	www.octiv.com		X		X										
On2 Technologies	www.on2.com			X									X		
Pivot Signal Processing, Ltd.	www.pivot-dsp.com			X					X		X			X	
Planning Systems, Inc.	www.plansys.com		X							X					
Prodys S.L.	www.prodys.net			X									X		
RadiSys Corp.	www.radsys.com			X							X			X	
Sasken Communication Technologies Ltd.	www.sasken.com		X										X		
SIAL Ltd.	www.dsp.sut.ru/sial/	X	X								X			X	X
Siemens AG Austria	www.pse.siemens.at		X		X										
Signals + Software Ltd.	www.signalsandsoftware.com		X	X				X			X	X	X		
SignalWorks	www.signalworks.com		X		X										
Snapshield Ltd.	www.snapshield.com		X	X					X						
Softier Ltd.	www.softier.com/			X									X		X
Sound ID	www.soundid.com		X		X										
Spatializer Audio Laboratories, Inc.	www.spatializer.com		X		X										
Spectrum Signal Processing, Inc.	www.spectrumsignal.com		X								X				
Speech Technology Center	www.speechpro.com		X								X				
SPIRIT CORP.	www.spiritDSP.com		X		X			X		X	X	X		X	
SRS Labs, Inc.	www.srslabs.com		X	X	X										
SURF Communication Solutions Ltd.	www.surf-com.com			X				X				X		X	
Technosoft	www.technosoft.ch/	X				X									
Treck, Inc.	www.treck.com		X	X				X							
Two Pi	www.two-pi.com/		X		X										
UB Video, Inc.	www.ubvideo.com		X	X									X		
UFMG-Universidade Federal de Minas Gerais	www.cpdee.ufmg.br	X				X									
Verance Corp.	www.verance.com		X						X						
Wavemakers, Inc.	www.wavemakers.com	X						X							
Windmill Innovations	www.windmill-innovations.com		X	X				X							
Wipro Ltd.	www.wipro.com		X											X	



Get the most updated information on eXpressDSP-compliant algorithms at: [www.ti.com/algorithms](http://www.ti.com/algorithms)

AUDIO		
Compliant Algorithm	Generation	Third-Party Vendor
3D Stereo	C54x	Spatializer Audio Labs
3D Stereo	C55x	Spatializer Audio Labs
AAC Decoder	C54x	Ingenient Technologies
AAC Decoder	C55x	SPIRIT CORP.
AAC Decoder	C62x	Ingenient Technologies
AAC Decoder	C62x	SPIRIT CORP.
AAC Decoder	C64x	SPIRIT CORP.
AAC Encoder	C62x	Ingenient Technologies
Acoustic Echo Canceller	C54x	Creative DSP Solutions
Acoustic Echo Canceller	C54x	Ingenient Technologies
Acoustic Echo Canceller	C54x	Indesign
Acoustic Echo Canceller	C54x	SPIRIT CORP.
Acoustic Echo Canceller	C55x	Creative DSP Solutions
Acoustic Echo Canceller	C55x	Ingenient Technologies
Acoustic Echo Canceller	C55x	SPIRIT CORP.
Acoustic Echo Canceller	C64x	Ingenient Technologies
Adaptive Noise Canceller	C54x	DSPepecialists GmbH
ASF-M	C54x	NCT Group
Chorus	C67x	Spectral Design
Circle Surround II	C67x	SRS Labs
Compressor	C67x	DSPepecialists GmbH
Dialog	C55x	SRS Labs
Equalizer	C67x	DSPepecialists GmbH
FEX_C5	C54x	Conversay
Flanger	C67x	DSPepecialists GmbH
Full Duplex Echo Cancellation	C54x	SignalWorks
Full Spectrum Dynamic Compression	C54x	Sound ID
Function Generator	C67x	DSPepecialists GmbH
Headphones	C54x	Spatializer Audio Labs
Headphones	C55x	Spatializer Audio Labs
Mixer	C67x	DSPepecialists GmbH
Mono Eq 4 Band	C67x	D+R Electronika B.V.
MP3 Decoder	C28x	SPIRIT CORP.
MP3 Decoder	C54x	SPIRIT CORP.
MP3 Decoder	C54x	Ittiam Systems
MP3 Decoder	C55x	SPIRIT CORP.
MP3 Decoder Gold	C54x	CuTe Solutions
MP3 Decoder Silver	C54x	CuTe Solutions
MP3 Encoder	C54x	Ingenient Technologies
MP3 Encoder	C54x	CuTe Solutions
MP3 Encoder	C55x	Ingenient Technologies
MP3 Encoder	C55x	CuTe Solution
MP3 Encoder	C62x	CuTe Solution
MP3 Encoder	C62x	Ingenient Technologies
MP3 Encoder	C62x	CuTe Solution
MPEG2 AAC Encoder	C67x	Fraunhofer IIS
MPEG2 L3 Decoder	C54x	Ingenient Technologies
MPEG2 L3 Decoder	C55x	Ingenient Technologies
MPEG2 L3 Decoder	C62x	Ingenient Technologies

AUDIO (CONTINUED)		
Compliant Algorithm	Generation	Third-Party Vendor
MPEG2/4 AAC Decoder	C64x	ATEME
MPEG2/4 AAC Decoder	C64x	Ittiam Systems
MPEG2/4 AAC Encoder	C64x	ATEME
MPEG2/4 AAC Encoder	C64x	Ittiam Systems
MPEG4 AAC LC Decoder	C54x	Ingenient Technologies
MPEG4 AAC LC Decoder	C55x	Ingenient Technologies
MPEG4 AAC LC Encoder	C62x	Ingenient Technologies
MPEG4 AAC LC Encoder	C64x	Ingenient Technologies
MPEG4 Decoder	C55x	Ingenient Technologies
Noise Reduction	C54x	Creative DSP Solutions
Noise Reduction	C55x	Creative DSP Solutions
Noise Reduction, Low Frequency	C54x	Alango
Octimax	C54x	Octiv
Octivox	C54x	Octiv
Pathfinder Noise Suppression	C55x	Aliph Com
Phase Corrected Equalization	C55x	Spatializer Audio Labs
Reverb	C67x	DSPepecialists GmbH
Sample Rate Conversion	C54x	Siemens AG Austria
Speech Compressor for Hearing Aids	C54x	Two Pi
Time-Scale Tailor	C54x	Enounce
Vi.B.E™	C54x	Spatializer Audio Labs
Vi.B.E	C55x	Spatializer Audio Labs
VoIP	C54x	SPIRIT CORP.
VoIP	C55x	SPIRIT CORP.
VIP – Voice Intelligibility	C54x	SRS Labs
VIP – Voice Intelligibility	C55x	SRS Labs
WMA Decoder	C54x	Ingenient Technologies
WMA Decoder	C55x	CuTe Solution
WOW – Voice	C54x	SRS Labs
WOW – Voice	C55x	SRS Labs

### DIGITAL MOTOR CONTROL (DMC)

Compliant Algorithm	Generation	Third-Party Vendor
Position Control	C24x	Technosoft
RMS Signal Measurement	C24x	RACOM Microelectronics
Speed Control	C24x	Technosoft
Torque Control for BLDC	C24x	Technosoft
Torque Control for IMVC	C24x	Technosoft
Torque Control for PMSM	C24x	Technosoft
Vector PWM for Neutral Point Clamped 3 Level Inverters	C24x	UFMG

### FAX

Compliant Algorithm	Generation	Third-Party Vendor
FAX Bundle (V.17/V.21/V.27/V.29)	C54x	SPIRIT CORP.
FAX G3 Rev 1.0 (V.21/V.27V.29)	C54x	SPIRIT CORP.
T.38 Fax Relay over IP	C54x	SPIRIT CORP.
T.38 Fax Relay over IP	C62x	SURF Communication Solns.
V.17	C54x	SPIRIT CORP.
V.17 Receive	C54x	MESi


**eXpressDSP™-Compliant Third-Party Algorithms**
**FAX (CONTINUED)**

Compliant Algorithm	Generation	Third-Party Vendor
V.17 Receive	C62x	Commetrex
V.17 Receive	C62x	ILLICO
V.17 Transmit	C54x	ILLICO
V.17 Transmit	C54x	MESi
V.17 Transmit	C62x	Commetrex
V.21	C54x	SPIRIT CORP.
V.21 Receive	C54x	MESi
V.21 Receive	C62x	Commetrex
V.21 Transmit	C54x	ILLICO
V.21 Transmit	C54x	MESi
V.21 Transmit	C62x	Commetrex
V.27 Receive	C54x	ILLICO
V.27 Transmit	C54x	ILLICO
V.27/V.29 Receive	C62x	Commetrex
V.27/V.29 Transmit	C62x	Commetrex
V.27ter	C54x	SPIRIT CORP.
V.27ter Receive	C54x	MESi
V.27ter Transmit	C54x	MESi
V.29	C54x	SPIRIT CORP.
V.29 Receive	C54x	ILLICO
V.29 Receive	C54x	MESi
V.29 Transmit	C54x	ILLICO
V.29 Transmit	C54x	MESi
V.29 Transmit/Receive	C54x	GAO Research Inc.

**PROTOCOL STACKS**

Compliant Algorithm	Generation	Third-Party Vendor
HDLC Generator Level 2	C54x	Bayer DSP
HDLC Receiver	C55x	Bayer DSP
HDLC Receiver Level 2	C54x	Bayer DSP
HDLC Transmitter	C55x	Bayer DSP
Serial Communications Protocol	C54x	Windmill Innovations
Serial Communications Protocol	C55x	Windmill Innovations
Serial Communications Protocol	C67x	Windmill Innovations
TCP/IP Protocol Stack	C54x	Windmill Innovations
TCP/IP Protocol Stack for Ethernet	C62x	Windmill Innovations
TCP/IP Protocol Stack for Ethernet	C67x	Windmill Innovations
Treck	C55x	Treck
Treck	C62x	Treck

**SECURITY**

Compliant Algorithm	Generation	Third-Party Vendor
3-DES	C54x	Ingenient Technologies
3-DES	C54x	Snapshield
3-DES	C55x	Ingenient Technologies
3-DES	C55x	Snapshield
AES	C54x	Snapshield
AES	C55x	Snapshield
AES	C62x	Snapshield
AES	C64x	Snapshield
Audio Watermark Det. SDMI Screen	C54x	Verance Corp.
BioKey	C62x	IdenCom
Biometrics Image Processing	C55x	Ethentica

**SECURITY (CONTINUED)**

Compliant Algorithm	Generation	Third-Party Vendor
DES	C54x	Ingenient Technologies
DES	C54x	Snapshield
DES	C55x	Ingenient Technologies
DES CBC Mode	C54x	Snapshield
Diffie-Hellman	C54x	Snapshield
Diffie-Hellman	C55x	Snapshield
Diffie-Hellman	C62x	Snapshield
ELGAMAL	C54x	Snapshield
ELGAMAL	C62x	Snapshield
Fingerprint 1 to 1	C54x	NeuroDynamics
Fingerprint Recognition Pre	C62x	IdentAlink
Fingerprint Recognition Engine	C62x	IdentAlink
HMAC	C54x	Ingenient Technologies
HMAC-MD5	C54x	Snapshield
HMAC-SHA-1	C54x	Snapshield
IDEA Decryption	C54x	easytools
IDEA Encryption	C54x	easytools
Kasumi Encryption	C67x	Pivot Signal Processing
MD5	C54x	Snapshield
MD5	C55x	Snapshield
MD5	C62x	Snapshield
MD5-V.2.0	C62x	Snapshield
MMH-MAC	C62x	Snapshield
NTRU Mobile Security	C55x	NTRU Cryptosystems
RSA	C54x	Snapshield
RSA1024	C54x	eSecurium
SHA-1	C54x	Snapshield
SHA-1	C55x	Snapshield
SHA-1	C62x	Snapshield

**SPEECH**

Compliant Algorithm	Generation	Third-Party Vendor
Adaptive Speech Filter (Enhancement)	C67x	NCT Group, Inc.
Broadband Noise Cancellation	C54x	Speech Technology Center
Caller ID Text-to-Speech	C55x	Fonix
Clear Voice Capture Dual-Element Mic	C54x	Clarity
Clear Voice Capture Single-Element Mic	C54x	Clarity
MPEG4 HVXC Speech Decoder	C54x	Ittiam Systems
MPEG4 HVXC Speech Encoder	C54x	Ittiam Systems
Real World Voice Recognition	C54x	NeuVoice
Real World Voice Recognition	C55x	NeuVoice
Referenced Noise Filter	C67x	NCT Group, Inc.
smARTspeak NG	C55x	Advanced Recognition Tech.
smARTspeak XG	C55x	Advanced Recognition Tech.
Sound Stretcher	C54x	Speech Technology Center
Speech Enhancement	C54x	SPIRIT CORP.
Text-to-Speech Synthesizer	C55x	Fonix
VoCon Speech Recognition Engine	C54x	Philips Speech Processing
Voice Command Recognition	C54x	Speech Technology Center
Voiceguard – Adapt	C54x	Planning Systems, Inc.
Voiceguard – Adapt	C55x	Planning Systems, Inc.
Voiceguard – HAB	C54x	Planning Systems, Inc.
Voiceguard – HAB	C55x	Planning Systems, Inc.

## eXpressDSP™-Compliant Third-Party Algorithms



### SPEECH (CONTINUED)

Compliant Algorithm	Generation	Third-Party Vendor
VoiceTrigger	C54x	Wavemakers
Voice Recognition	C55x	Advanced Recognition Tech.

### TELEPHONY

Compliant Algorithm	Generation	Third-Party Vendor
2100-Hz Tone Detector	C62x	Signals + Software
Acoustic Echo Canceller	C54x	SPIRIT CORP.
Auto Gain Control/Voice Activity Det	C62x	RadiSys Corp.
Automatic Gain Control	C54x	Ingenient Technologies
Automatic Gain Control	C54x	SPIRIT CORP.
Automatic Gain Controller	C62x	Signals + Software
Automatic Gain Control	C64x	Ingenient Technologies
Call Progress Analysis	C54x	Commetrex
Call Progress Analysis	C62x	Commetrex
Call Progress Decoder	C54x	Ingenient Technologies
Call Progress Detector	C54x	SPIRIT CORP.
Call Progress Generator	C54x	SPIRIT CORP.
Call Progress Monitor	C62x	RadiSys Corp.
Call Progress Tone Detector	C54x	Adaptive Digital Technologies
Caller ID	C54x	Ingenient Technologies
Caller ID	C54x	SPIRIT CORP.
Caller ID Detector	C54x	MESi
Caller ID Detector	C54x	SPIRIT CORP.
Caller ID Generator	C54x	MESi
Caller ID Generator	C54x	SPIRIT CORP.
Caller ID Receiver	C62x	Commetrex
Caller ID Transmitter	C54x	Commetrex
Caller ID Transmitter	C62x	Commetrex
Caller ID, Type 1 and 2	C54x	GAO Research Inc.
Comfort Noise Generator	C54x	SPIRIT CORP.
Comfort Noise Generator	C62x	RadiSys Corp.
CPE Alert Signal	C54x	D2 Technologies
CPT Detector	C54x	Bayer DSP
CPT Detector	C55x	Bayer DSP
CPT Generator	C54x	Bayer DSP
CPT Generator	C55x	Bayer DSP
DTMF	C54x	D2 Technologies
DTMF	C54x	SPIRIT CORP.
DTMF	C62x	Spectrum Signal Processing
DTMF Detector	C54x	Adaptive Digital Technologies
DTMF Detector	C54x	Commetrex
DTMF Detector	C54x	Ingenient Technologies
DTMF Detector	C54x	MESi
DTMF Detector	C62x	Commetrex
DTMF Detector / Suppressor	C62x	RadiSys Corp.
DTMF Encoder	C54x	Ingenient Technologies
DTMF Encoder/Decoder	C54x	Ingenient Technologies
DTMF Generator	C54x	Commetrex
DTMF Generator	C54x	MESi
DTMF Generator	C54x	SPIRIT CORP.
DTMF Generator	C62x	Commetrex
DTMF Receiver	C54x	Bayer DSP
DTMF Receiver	C54x	Signals + Software

### TELEPHONY (CONTINUED)

Compliant Algorithm	Generation	Third-Party Vendor
DTMF Receiver	C54x	SIAL
DTMF Receiver	C54x	SPIRIT CORP.
DTMF Receiver	C55x	Bayer DSP
DTMF Receiver	C62x	Motorola Computer Group
DTMF Transmitter	C54x	Bayer DSP
DTMF Transmitter	C54x	Signals + Software
DTMF Transmitter	C55x	Bayer DSP
DTMF Transmitter	C62x	Motorola Computer Group
DTMF Transmitter	C62x	Signals + Software
Echo Cancellation, Multi-	C54x	D2 Technologies
Echo Canceller	C54x	Ingenient Technologies
Echo Canceller	C55x	Ingenient Technologies
Echo Canceller	C62x	Ingenient Technologies
Echo Canceller	C64x	Ingenient Technologies
Fax and Modem Tone Detect	C54x	D2 Technologies
Frequency Shift Key Rec	C54x	D2 Technologies
Frequency Shift Key Send	C54x	D2 Technologies
G.165	C54x	Bayer DSP
G.165	C54x	SPIRIT CORP.
G.165	C55x	Bayer DSP
G.165	C55x	SPIRIT CORP.
G.165 Line Echo Cancellation	C62x	RadiSys Corp.
G.167	C54x	Bayer DSP
G.167	C55x	Bayer DSP
G.168	C54x	DACS Software
G.168	C54x	Ingenient Technologies
G.168	C55x	Ingenient Technologies
G.168	C62x	Ingenient Technologies
G.168	C64x	Ingenient Technologies
G.168 (Long Tail)	C54x	Adaptive Digital Technologies
G.168 (Long Tail)	C55x	Adaptive Digital Technologies
G.168 (Long Tail)	C64x	Adaptive Digital Technologies
G.168 (Short Tail)	C54x	Adaptive Digital Technologies
G.168 (Short Tail)	C55x	Adaptive Digital Technologies
G.168-2000	C54x	SPIRIT CORP.
G.168-2000	C55x	SPIRIT CORP.
LEC-128-HelloVoice™ Line Echo	C55x	HelloSoft
Line Echo Canceller	C55x	HelloSoft
MF R1 Detector	C54x	Adaptive Digital Technologies
MF R2 Forward Detector	C54x	Adaptive Digital Technologies
MF R2 Reverse Detector	C54x	Adaptive Digital Technologies
MF Line/Register Signaling	C62x	RadiSys Corp.
Multifrequency Tone Detect	C54x	D2 Technologies
Music On Hold	C54x	Bayer DSP
Noise Floor Estimation	C54x	D2 Technologies
Non-Linear Processing	C54x	D2 Technologies
SoundClear Echo Cancel & Noise Red	C54x	Acoustic Technologies
SoundClear Echo Cancel & Noise Red	C55x	Acoustic Technologies
TMWRTW	C67x	Ingenient Technologies
Tone Detector	C54x	Commetrex
Tone Detector	C54x	MESi
Tone Detector	C62x	Commetrex



## → eXpressDSP™-Compliant Third-Party Algorithms

### TELEPHONY (CONTINUED)

Compliant Algorithm	Generation	Third-Party Vendor
Tone Detector	C64x	Commetrex
Tone Disabler for LEC	C54x	SPIRIT CORP.
Tone Generator	C54x	Commetrex
Tone Generator	C54x	D2 Technologies
Tone Generator	C54x	MESi
Tone Generator	C62x	Commetrex
Tone Generator	C62x	RadiSys Corp.
Universal Tone Detection	C54x	D2 Technologies
Univ Multifrequency Tone Generator	C54x	SPIRIT CORP.
Univ Multifrequency Tone Generator	C55x	SPIRIT CORP.
Variable Rate Convl. CODEC w/ Soft Decision VITERBI Decoding	C54x	Ingenient Technologies
Voice Activity Detector	C62x	RadiSys Corp.
Voice Activity Detection	C54x	Ingenient Technologies
Voice Activity Detection	C54x	SPIRIT CORP.
Voice Activity Detection	C55x	Ingenient Technologies
Voice Activity Detection	C62x	Ingenient Technologies
Voice Activity Detection	C64x	Ingenient Technologies
Voice Activity Detector	C54x	D2 Technologies
Voice Activity Detector	C62x	Signals + Software

### VB MODEM

Compliant Algorithm	Generation	Third-Party Vendor
AGC	C54x	Ingenient Technologies
AGC	C54x	SPIRIT CORP.
BELL 103 Modem (demod)	C54x	MESi
BELL 103 Modem (mod)	C54x	MESi
BELL 202 Modem (demod)	C54x	MESi
BELL 202 Modem (mod)	C54x	MESi
Binary Phase Shift Key Modem	C54x	Ingenient Technologies
Binary Phase Shift Key Modem	C64x	Ingenient Technologies
DTMF Generator	C54x	Ingenient Technologies
G3MDP	C54x	SPIRIT CORP.
Soft Modem (Medium speed)	C54x	Netbricks
UPD Fax/Modem Pumps	C55x	SPIRIT CORP.
UPD Modem Pumps	C55x	SPIRIT CORP.
UDP V.23 Fax/Modem Pumps	C55x	SPIRIT CORP.
Univ Multifrequency Tone Detect	C54x	SPIRIT CORP.
Univ Multifrequency Tone Detect	C55x	SPIRIT CORP.
V.21 Receive	C54x	ILLICO
V.21 Transmit/Receive	C54x	GAO Research Inc.
V.22	C54x	Ingenient Technologies
V.22 bis Transmit/Receive	C54x	GAO Research Inc.
V.22 bis Transmit/Receive	C54x	MESi
V.23 Receive	C54x	MESi
V.23 Transmit	C54x	MESi
V.23 Transmit/Receive	C54x	GAO Research Inc.
V.32 / V.32 bis / V.22 / V.22 bis	C54x	SPIRIT CORP.
V.32 bis	C54x	GAO Research Inc.
V.32 bis	C54x	MESi
V.32 bis	C54x	SPIRIT CORP.
V.32 Transmit/Receive	C54x	ILLICO
V.34 Data Pump	C54x	GAO Research Inc.

### VB MODEM (CONTINUED)

Compliant Algorithm	Generation	Third-Party Vendor
V.34/V.34+	C62x	SURF Communication Solns.
V.42	C54x	SPIRIT CORP.
V.42 bis	C54x	GAO Research Inc.
V.42 bis	C54x	SPIRIT CORP.
V.42 bis Decoder	C62x	Signals + Software
V.42 bis Encoder	C62x	Signals + Software
V.90	C62x	SURF Communication Solns.
V.90 Data Pump	C54x	GAO Research Inc.
V.150	C64x	SURF Communication Solns.

### VIDEO & IMAGING

Compliant Algorithm	Generation	Third-Party Vendor
Digital Video-25	DM64x	Mecoso Technology
H.261 Decoder	C62x	UB Video
H.261 Encoder	C62x	UB Video
H.263 Decoder	C62x	Dilithium Networks
H.263 Decoder	C62x	Mecoso Technology
H.263 Decoder Ver 1.0	C62x	UB Video
H.263 Decoder Ver 2.0	C62x	UB Video
H.263 Encoder	C55x	Emuzed
H.263 Encoder	C62x	Emuzed
H.263 Encoder	C62x	Mecoso Technology
H.263 Encoder	C64x	Emuzed
H.263 Encoder Ver 1.0	C62x	UB Video
H.263 Encoder Ver 2.0	C62x	UB Video
H.263 TDM to/from H.263 TCP/IP	C62x	Dilithium Networks
JPEG Codec	C54x	ATEME
JPEG Codec	C55x	ATEME
JPEG Codec	C62x	ATEME
JPEG Codec	DM64x	Mecoso Technology
JPEG Decoder	C54x	ATEME
JPEG Decoder	C55x	ATEME
JPEG Decoder	C55x	Emuzed
JPEG Decoder	C62x	ATEME
JPEG Decoder	C64x	ATEME
JPEG Encoder	C54x	ATEME
JPEG Encoder	C55x	ATEME
JPEG Encoder	C55x	Emuzed
JPEG Encoder	C62x	ATEME
JPEG Encoder	C62x	Mango DSP
JPEG Encoder	C64x	ATEME
MJPEG Codec	C54x	ATEME
MJPEG Codec	C55x	ATEME
MJPEG Codec	C62x	ATEME
MJPEG Codec	DM64x	Mecoso Technology
MJPEG Decoder	C54x	ATEME
MJPEG Decoder	C55x	ATEME
MJPEG Decoder	C62x	ATEME
MJPEG Encoder	C54x	ATEME
MJPEG Encoder	C55x	ATEME
MJPEG Encoder	C62x	ATEME
MPEG1 Decoder	C62x	Mecoso Technology
MPEG1 Encoder	C62x	Mecoso Technology

## eXpressDSP™-Compliant Third-Party Algorithms



### VIDEO & IMAGING (CONTINUED)

Compliant Algorithm	Generation	Third-Party Vendor
MPEG2 Decoder	C62x	ATEME
MPEG2 Decoder	C64x	ATEME
MPEG4 Adv. Simple Profile Decoder	C62x	Ingenient Technologies
MPEG4 Adv. Simple Profile Encoder	C62x	Ingenient Technologies
MPEG4 Adv. Simple Profile Encoder	C64x	Prodys
MPEG4 ASP Level 4 Encoder	C64x	Prodys
MPEG4 Core Profile Encoder	C64x	Prodys
MPEG4 Decoder	C55x	Sasken Communication Tech.
MPEG4 Decoder	C55x	UB Video
MPEG4 Decoder	C62x	ATEME
MPEG4 Decoder	C62x	Dilithium Networks
MPEG4 Decoder	C62x	Mecoso Technology
MPEG4 Decoder	C64x	ATEME
MPEG4 Encoder	C55x	UB Video
MPEG4 Encoder	C62x	Mecoso Technology
MPEG4 Encoder	C64x	Prodys
MPEG4 Simple Profile	C64x	Ittiam Systems
MPEG4 Simple Profile Decoder	C62x	Ingenient Technologies
MPEG4 Simple Profile Decoder	C62x	Prodys
MPEG4 Simple Profile Decoder	C64x	Ingenient Technologies
MPEG4 Simple Profile Decoder	C64x	Prodys
MPEG4 Simple Profile Encoder	C62x	Ingenient Technologies
MPEG4 Simple Profile Encoder	C62x	Prodys
MPEG4 Simple Profile Encoder	C64x	Ingenient Technologies
MPEG4 Simple Profile Encoder	C62x	Prodys
MPEG4 Simple Profile Video Decoder	C55x	Emuzed
MPEG4 Simple Profile Video Decoder	C62x	Prodys
MPEG4 Simple Profile Video Decoder	C64x	Prodys
MPEG4 Simple Profile Video Encoder	C55x	Emuzed
MPEG4 Simple Profile Video Encoder	C62x	Emuzed
MPEG4 Simple Profile Video Encoder	C64x	Emuzed
MPEG4 VSP Decoder	C64x	ATEME
VP4 Decoder	C62x	On2 Technologies
VP4 Decoder	C64x	On2 Technologies

### VOCODERS

Compliant Algorithm	Generation	Third-Party Vendor
1200-BPS Decoder	C54x	SPIRIT CORP.
1200-BPS Encoder	C54x	SPIRIT CORP.
1200-BPS Vocoder	C55x	SPIRIT CORP.
2400-BPS Decoder	C54x	SPIRIT CORP.
2400-BPS Encoder	C54x	SPIRIT CORP.
2400-BPS Vocoder	C55x	SPIRIT CORP.
4800-BPS Vocoder	C54x	SPIRIT CORP.
4800-BPS Vocoder	C55x	SPIRIT CORP.
6000-BPS Vocoder	C54x	SPIRIT CORP.
6000-BPS Vocoder	C55x	SPIRIT CORP.
Enhanced G.711	C54x	Global IP Sound AB
ESAC4 Decoder	C55x	Cybernetics Infotech
ESAC4 Encoder	C55x	Cybernetics Infotech
ESAC7 Decoder	C55x	Cybernetics Infotech
ESAC7 Encoder	C55x	Cybernetics Infotech
G.168	C62x	Signals + Software

### VOCODERS (CONTINUED)

Compliant Algorithm	Generation	Third-Party Vendor
G.711 Decoder	C54x	Commetrex
G.711 Decoder	C54x	Ingenient Technologies
G.711 Decoder	C54x	Signals + Software
G.711 Decoder	C54x	SPIRIT CORP.
G.711 Decoder	C55x	Ingenient Technologies
G.711 Decoder	C55x	SPIRIT CORP.
G.711 Decoder	C62x	Commetrex
G.711 Decoder	C62x	Ingenient Technologies
G.711 Decoder	C62x	Motorola Computer Group
G.711 Decoder	C62x	RadiSys Corp.
G.711 Decoder	C62x	Signals + Software
G.711 Decoder	C64x	Ittiam Systems
G.711 Encoder	C54x	Commetrex
G.711 Encoder	C54x	Ingenient Technologies
G.711 Encoder	C54x	Signals + Software
G.711 Encoder	C54x	SPIRIT CORP.
G.711 Encoder	C55x	Ingenient Technologies
G.711 Encoder	C55x	SPIRIT CORP.
G.711 Encoder	C62x	Commetrex
G.711 Encoder	C62x	Ingenient Technologies
G.711 Encoder	C62x	Motorola Computer Group
G.711 Encoder	C62x	RadiSys Corp.
G.711 Encoder	C62x	Signals + Software
G.711 Encoder	C64x	Ittiam Systems
G.711 PLC	C54x	SPIRIT CORP.
G.711 PLC	C55x	SPIRIT CORP.
G.722 Decoder	C62x	RadiSys Corp.
G.722 Decoder	C62x	Signals + Software
G.722 Decoder	C64x	Ittiam Systems
G.722 Encoder	C62x	RadiSys Corp.
G.722 Encoder	C62x	Signals + Software
G.722 Encoder	C64x	Ittiam Systems
G.722.1 Decoder	C54x	SIAL
G.722.1 Decoder	C64x	Ittiam Systems
G.722.1 Encoder	C54x	SIAL
G.722.1 Encoder	C64x	Ittiam Systems
G.722.2 Decoder	C62x	Pivot Signal Processing
G.723.1	C54x	Encore Software
G.723.1	C54x	GAO Research Inc.
G.723.1	C62x	Encore Software
G.723.1 Decoder	C54x	SPIRIT CORP.
G.723.1 Decoder	C55x	SPIRIT CORP.
G.723.1 Decoder	C62x	RadiSys Corp.
G.723.1 Decoder	C62x	Signals + Software
G.723.1 Decoder	C62x	SPIRIT CORP.
G.723.1 Encoder	C54x	SPIRIT CORP.
G.723.1 Encoder	C55x	SPIRIT CORP.
G.723.1 Encoder	C62x	RadiSys Corp.
G.723.1 Encoder	C62x	Signals + Software
G.723.1 Encoder	C62x	SPIRIT CORP.
G.723.1 Encoder/Decoder	C54x	Adaptive Digital Technologies
G.723.1 Encoder/Decoder	C54x	GAO Research Inc.



## eXpressDSP™-Compliant Third-Party Algorithms

### VOCODERS (CONTINUED)

Compliant Algorithm	Generation	Third-Party Vendor
G.723A Decoder	C54x	D2 Technologies
G.723A Encoder	C54x	D2 Technologies
G.726	C54x	Encore Software
G.726	C62x	Encore Software
G.726 A-Law ADPCM Decoder	C62x	RadiSys Corp.
G.726 A-Law ADPCM Encoder	C62x	RadiSys Corp.
G.726 ADPCM Decoder/Encoder	C54x	SPIRIT CORP.
G.726 ADPCM Decoder/Encoder	C55x	SPIRIT CORP.
G.726 Decoder	C54x	Commetrex
G.726 Decoder	C54x	D2 Technologies
G.726 Decoder	C54x	National Instru./Hyperception
G.726 Decoder	C54x	Ingenient Technologies
G.726 Decoder	C54x	Signals + Software
G.726 Decoder	C54x	SPIRIT CORP.
G.726 Decoder	C55x	DSP Wizard
G.726 Decoder	C55x	SPIRIT CORP.
G.726 Decoder	C62x	Commetrex
G.726 Decoder	C62x	National Instru./Hyperception
G.726 Decoder	C62x	Ingenient Technologies
G.726 Decoder	C62x	Ingenient Technologies
G.726 Decoder	C62x	Signals + Software
G.726 Decoder	C64x	Ittiam Systems
G.726 Decoder (Low MIPS)	C54x	Adaptive Digital Technologies
G.726 Encoder	C54x	Commetrex
G.726 Encoder	C54x	D2 Technologies
G.726 Encoder	C54x	National Instru./Hyperception
G.726 Encoder	C54x	Ingenient Technologies
G.726 Encoder	C54x	Signals + Software
G.726 Encoder	C54x	SPIRIT CORP.
G.726 Encoder	C55x	DSP Wizard
G.726 Encoder	C55x	SPIRIT CORP.
G.726 Encoder	C62x	Commetrex
G.726 Encoder	C62x	National Instru./Hyperception
G.726 Encoder	C62x	Ingenient Technologies
G.726 Encoder	C62x	Ingenient Technologies
G.726 Encoder	C62x	Signals + Software
G.726 Encoder	C64x	Ittiam Systems
G.726 Encoder (Low MIPS)	C54x	Adaptive Digital Technologies
G.726 Encoder/Decoder (Low Memory)	C54x	Adaptive Digital Technologies
G.726 U-Law ADPCM Decoder	C62x	RadiSys Corp.
G.726 U-Law ADPCM Encoder	C62x	RadiSys Corp.
G.726/G.711	C55x	SPIRIT CORP.
G.728	C62x	Encore Software
G.728 Decoder	C54x	Signals + Software
G.728 Decoder	C62x	Signals + Software
G.728 Decoder	C64x	Ittiam Systems
G.728 Encoder	C54x	Signals + Software
G.728 Encoder	C62x	Signals + Software
G.728 Encoder	C64x	Ittiam Systems
C.729	C55x	Wipro
G.729	C62x	Encore Software
G.729 Decoder	C54x	Signals + Software

### VOCODERS (CONTINUED)

Compliant Algorithm	Generation	Third-Party Vendor
G.729 Decoder	C54x	SPIRIT CORP.
G.729 Decoder	C55x	DSP Wizard
G.729 Decoder	C55x	SPIRIT CORP.
G.729 Decoder	C62x	RadiSys Corp.
G.729 Decoder	C62x	Signals + Software
G.729 Decoder	C62x	SIAL
G.729 Decoder	C62x	SURF Communication Solns.
G.729 Encoder	C54x	Signals + Software
G.729 Encoder	C54x	SPIRIT CORP.
G.729 Encoder	C55x	DSP Wizard
G.729 Encoder	C55x	SPIRIT CORP.
G.729 Encoder	C62x	RadiSys Corp.
G.729 Encoder	C62x	Signals + Software
G.729 Encoder	C62x	SIAL
G.729 Encoder	C62x	SURF Communication Solns.
G.729 Encoder/Decoder	C54x	Adaptive Digital Technologies
G.729A	C54x	Encore Software
G.729A Decoder	C54x	D2 Technologies
G.729A Decoder	C54x	Signals + Software
G.729A Decoder	C55x	DSP Wizard
G.729A Decoder	C62x	RadiSys Corp.
G.729A Decoder	C62x	Signals + Software
G.729A Decoder	C62x	Signals + Software
G.729A Encoder	C54x	Signals + Software
G.729A Encoder	C55x	DSP Wizard
G.729A Encoder	C62x	RadiSys Corp.
G.729A Encoder	C62x	Signals + Software
G.729A Encoder/Decoder	C54x	Adaptive Digital Technologies
G.729A Encoder/Decoder	C54x	GAO Research Inc.
G.729AB	C62x	CuTe Solution
G.729AB Decoder	C54x	D2 Technologies
G.729AB Decoder	C54x	HelloSoft
G.729AB Decoder	C54x	Signals + Software
G.729AB Decoder	C55x	DSP Wizard
G.729AB Decoder	C55x	HelloSoft
G.729AB Decoder	C62x	RadiSys Corp.
G.729AB Decoder	C62x	Signals + Software
G.729AB Encoder	C54x	D2 Technologies
G.729AB Encoder	C54x	HelloSoft
G.729AB Encoder	C54x	Signals + Software
G.729AB Encoder	C55x	DSP Wizard
G.729AB Encoder	C55x	HelloSoft
G.729AB Encoder	C62x	RadiSys Corp.
G.729AB Encoder	C62x	Signals + Software
G.729AB Encoder/Decoder	C54x	Adaptive Digital Technologies
G.729AB Encoder/Decoder	C54x	SPIRIT CORP.
G.729AB Encoder/Decoder	C55x	SPIRIT CORP.
G.729B Decoder	C54x	D2 Technologies
G.729B Decoder	C54x	Signals + Software
G.729B Decoder	C55x	DSP Wizard
G.729B Decoder	C62x	Signals + Software
G.729E Encoder	C54x	D2 Technologies
G.729B Encoder	C54x	Signals + Software

## eXpressDSP™-Compliant Third-Party Algorithms



### VOCODERS (CONTINUED)

Compliant Algorithm	Generation	Third-Party Vendor
G.729B Encoder	C55x	DSP Wizard
G.729B Encoder	C62x	Signals + Software
G.729B Encoder/Decoder	C54x	Adaptive Digital Technologies
G.729E Decoder	C54x	D2 Technologies
G.729E Encoder	C54x	D2 Technologies
G723.1 Decoder	C62x	SURF Communication Solns.
G723.1 Encoder	C62x	SURF Communication Solns.
IPCM Wideband	C54x	Global IP Sound AB
Voice Activity Detector	C54x	Ingenient Technologies
Voice Activity Detector	C62x	Ingenient Technologies
Voice Activity Detector	C64x	Ingenient Technologies

### WIRELESS

Compliant Algorithm	Generation	Third-Party Vendor
G.723.1/GSM-AMR Transcoder	C62x	Dilithium Networks
GSM AMR Decoder	C55x	HelloSoft
GSM AMR Decoder	C55x	Emuzed
GSM AMR Encoder	C55x	Emuzed
GSM AMR Encoder	C55x	HelloSoft
GSM-AMR/G.723.1 Transcoder	C62x	Dilithium Networks
GSM AMR Wideband Decoder	C55x	Emuzed
GSM AMR Wideband Encoder	C55x	Emuzed
GSM Enhanced Full-Rate Decoder	C54x	SIAL
GSM Enhanced Full-Rate Decoder	C62x	Signals + Software
GSM Enhanced Full-Rate Encoder	C54x	SIAL
GSM Enhanced Full-Rate Encoder	C62x	Signals + Software
GSM Full-Rate Decoder	C54x	Bayer DSP
GSM Full-Rate Decoder	C55x	Bayer DSP
GSM Full-Rate Decoder	C62x	Signals + Software
GSM Full-Rate Encoder	C54x	Bayer DSP
GSM Full-Rate Encoder	C55x	Bayer DSP
GSM Full-Rate Encoder	C62x	Signals + Software

### View Updated eXpressDSP-Compliant Third Party Algorithm List

The eXpressDSP-compliant Third Party algorithm list is updated monthly highlighting the newest third-party algorithms. See the most recent list at [www.ti.com/algorithms](http://www.ti.com/algorithms)



## eXpressDSP™-Compliant Third-Party Plug-Ins

Get the most updated information on eXpressDSP-compliant plug-ins at: [www.ti.com/plugin-ins](http://www.ti.com/plugin-ins)

### What is a Plug-In?

A plug-in is a software application that integrates with, customizes or extends the Code Composer Studio™ IDE with additional specialized functionality. Plug-ins provide a wide range of tools for every step of the development process to assist you to develop DSP applications quickly and effectively. This allows you to focus on developing features to differentiate your TI DSP-based product and release more robust products to market faster.

### How Plug-Ins Speed Development

Using standard tools, the development cycle consists of four stages: application design, code & build, debug, and analyze & tune. Specialized plug-ins can be integrated into each step of the development flow to decrease the overall time to product deployment. By using third-party plug-ins during the application design and code & build stages, you can build your application fast. Plug-ins used during the debug and analyze & tune stages make your application perfect. Plug-ins also enable you to use familiar tools with TI DSPs. This reduces the learning curve and enables you to focus on innovation.

Some examples of plug-in types are as follows.

- **Application Generation** – generate C code or a complete application from a block diagram tool or generate a simple

project skeleton for a development board.

- **External Text Editors** – enable developers to use an editor they already know.
- **Filter Design** – insert filter code, integrate modified filter parameters into projects and analyze digital filters.
- **Hardware Support** – assist with installation, setup, configuration and diagnostics of development boards.
- **System Simulation** – concurrently simulate both hardware and software portions of a system.
- **Code Analysis** – provide code coverage, automate code testing and analyze code structures and arrays.
- **Code Testing** – generate test stubs and system testing utilities.
- **Real-Time Analysis** – provide controls to TI's DSP/BIOS™ kernel or other third party operating systems for dynamic execution profilers that can show developers exactly where they are spending their CPU cycles.
- **Real-Time Instrumentation** – visually analyze data from target using RTDX™.
- **Run-Time Error Analysis** – detect memory leaks, array index errors, function parameters, return errors and data errors.

### eXpressDSP-Compliant Plug-Ins Available Today Include:

Name	Contact	Stage of the Development Cycle				TI DSP Platform		
		Application Design	Code & Build	Debug	Analyze & Tune	C6000™	C5000™	C2000™
Borland Corporation CodeWright	<a href="http://www.borland.com">www.borland.com</a>		X			X	X	
Elanix SystemView's Real-Time DSP Architect	<a href="http://www.elanix.com">www.elanix.com</a>	X	X			X	X	
National Instruments / Hyperception, Inc. eXpressDSP™ Component Wizard LabView DSP Test Integration Toolkit for TI DSP Visual Application Builder	<a href="http://www.ni.com">www.ni.com</a>	X X X		X	X	X X X	X X X	X X X
Pentek, Inc. SwiftNet Debug Manager SwiftNet Project Manager	<a href="http://www.pentek.com">www.pentek.com</a>	X X				X X		
Rational Software Corporation Rational Test Real-Time Plug-In	<a href="http://www.rational.com">www.rational.com</a>			X	X	X		
Technosoft Control Panel Global Variable Visualizer for Digital Motor Controllers (DMCs) Graphical I/O Registers Viewer for DMCs Data Logger Tool for DMCs Reference Generator for Motion Reference for DMCs	<a href="http://www.technosoft.ch">www.technosoft.ch</a>				X			X X X X
The MathWorks, Inc. Filter Design Toolbox MATLAB® Link for Code Composer Studio (CCStudio) IDE SIMULINK® Embedded Target for C6000™ DSP Platform	<a href="http://www.mathworks.com">www.mathworks.com</a>	X X X	X X	X X	X X	X X X	X X	X X X
Vector Software, Inc. VectorCAST for CCStudio	<a href="http://www.vectors.com">www.vectors.com</a>			X		X	X	X
Visual Solutions Incorporated VisSim™-CCStudio Plug-In	<a href="http://www.vissim.com">www.vissim.com</a>	X	X			X		X

X – supported

## TI DSP Third Party Network Consultants



### Texas Instruments DSP Third Party Network Consultant Service Providers

More than 300 member consultants provide TMS320™ DSP-related services to help accelerate development efforts and reduce time-to-market. These consultants simplify the navigation of “best fit” solutions for customers and Texas Instruments. Our members are located worldwide in order to provide customers with the best service.

For more TI Third Party consultant providers, please visit [www.ti.com/3pconsultants](http://www.ti.com/3pconsultants)



*Third Party Consultants located worldwide*

**TI Third Party Consultants  
Accelerate Your Design Time.**

### European Consultants

Region	Company	Country/Location	Phone	Website	Description
South Europe	D & P Electronics	Italy	+ 39.06.9322025	<a href="http://www.depelsys.it">www.depelsys.it</a>	Offers hardware, software and system development support for ground and airborne RADARS, video transmission and presentation for airport surveillance, real-time control systems for industrial, military and telecom applications.
South Europe	CRESITT Industrie	France	+ 33-2 38 49 4559	<a href="http://www.cresitt.com">www.cresitt.com</a>	Consulting company supporting DSP development, regional DSP technology deployment and DSP marketing and communication seminars.
South Europe	Multimedia Technologies Institute - MTI S.r.l.	Italy	+ 39 (0)95 7224945	<a href="http://www.mtionline.it">www.mtionline.it</a>	A hi-tech laboratory operating in the field of interactive multimedia technology and especially the study, design and implementation of advanced DSP algorithms and systems.
Israel	DSP-IP	Israel	+ 972-545-313092	<a href="http://www.dsp-ip.com">www.dsp-ip.com</a>	A consulting, development and solution company for multimedia and biomedical applications.
Israel	Sightsys	Israel	+ 972-3-9222771	<a href="http://www.sightsys.com">www.sightsys.com</a>	Provides a complete solution of development tools, testing solutions and engineering services for infrastructure embedded hardware and software.
Israel	GS-Technologies	Israel	+ 972-54-6551204	<a href="http://www.gs-tech.co.il">www.gs-tech.co.il</a>	Specializes in professional embedded solutions for a wide range of applications and offers consulting services of the best tools for the design and development of complex embedded systems.
North Europe	ML Electronics	UK	+ 44(0)870 835 8416	<a href="http://www.ml-electronics.co.uk">www.ml-electronics.co.uk</a>	A British based electronic development & consulting company in: DSP, embedded, instrumentation, power supply, motor drives, communications and interfaces, instrumentation, software and other leading-edge technologies.
North Europe	Plextek	UK	+44 (0) 1799 533200	<a href="http://www.plextek.co.uk">www.plextek.co.uk</a>	Europe's largest independent design consultancy specializing in DSP design for telecommunications, defense and the medical field.
North Europe	Generics Group	UK	+44 1223 875200	<a href="http://www.generics.co.uk">www.generics.co.uk</a>	A leading integrated technology consulting and development organization with an international reputation for successfully commercializing emerging science and technology.
Central Europe	Drivetek	Switzerland	+41 32 332 79 37	<a href="http://www.drivetek.ch">www.drivetek.ch</a>	A technical consulting company specializing in the analysis, design and development of customized AC/DC motor drives, motion control, and power electronics application systems.
Central Europe	X-SPEX	Germany	+49 30 7076 1363	<a href="http://www.x-spex.de">www.x-spex.de</a>	A team of long-time experienced DSP engineers providing consulting, hardware, software, system integration services in Germany, Austria and Asia.
Central Europe	Ingenieurburo Bayer DSP Solutions	Germany	+49-211-2108120	<a href="http://www.dsp-bayer.de">www.dsp-bayer.de</a>	Provides consulting, tools, hardware, software, algorithms and integration services around DSP applications. A major focus is on telecommunication applications, security devices, VoIP, MP3 radio, etc.
Central Europe	D.SignT	Germany	+49 2833 / 5709 77	<a href="http://www.dsignt.de">www.dsignt.de</a>	Experts in DSP technology that provide off-the-shelf solutions for embedded DSP systems in the industrial control and automotive field.



## TI DSP Third Party Network Consultants

### USA Consultants

Region	Company	Country/Location	Phone	Website	Description
Central	Logic Product Development	Minnesota	612-672-9495	www.logicpd.com	Provides consulting services for OMAP™ processor and TMS320C6000™ DSP technology, along with combining user research, design, technology and manufacturing to create innovative new products and product categories.
Central	INDesign	Indianapolis, IN	317-377-5465	www.indesign-llc.com	Extensive background in DSP and embedded microcontrollers design and development for telecommunication, networking, gaming, entertainment, computer, medical applications.
Central	Paragon Innovations	Texas	972-265-6000	www.paragoninnovations.com	Consulting and outsourcing hardware and software embedded systems development for medical, telecom, consumer, industrial control, evaluation and reference boards.
Central	Plexus Corporation	Neenah, WI	920-722-3451	www.plexus.com	A leader in the Electronics Manufacturing Services (EMS) industry in turning product concepts into world-class products. Extensive DSP design experience supporting product design and development, especially in the telecommunications, defense and medical fields.
Central	Tier Electronics	Oconomowoc, WI	262-790-9500	www.tierelectronics.com	Specializes in the design of custom and semi-custom power electronics products for motor control, appliance, power tool, power line quality incorporating DSP controllers, embedded intelligence, wireless and other technologies.
East	D3 Engineering	Rochester, NY	585-429-1550	www.d3engineering.com	A DSP engineering service company that provides hardware, software and algorithm design services, with DSP expertise in wireless, imaging and motion control applications.
East	Nova Engineering	Cincinnati, OH	800-341-6682	www.nova-eng.com	Provides design and analysis for hardware and software development in a wide array of electronic systems, possessing particular expertise with the TMS320C3x™, TMS320C5x™ and TMS320C54x™ DSPs.
West	Nuvation Engineering	California	408-228-5580 x122	www.nuvation.com	Consulting and DSP services that include: system architecture, FPGA/DSP co-processing designs, MATLAB® algorithm development, DSP code development, DSP hardware, development, integration and turnkey product realization.
West	Clarity Design, Inc.	California	858-668-2981	www.claritydsn.com	A full-service engineering company that can assist with DSP selection, electrical engineering, software development or application code, along with single- or multi-processor based systems and TI DSP audio and video design.
West	CEO Consultancy, Inc.	Irvine, CA	888-387-1470	www.ceoconsultancy.com	Services include DSP and xDAIS™ algorithm development, video processing, image processing, audio algorithms, device controllers and communication interfaces.
West	Dorr Engineering Services, Inc.	San Marcos, CA	760-510-1835	www.dorrengeering.com	Consulting firm specializing in RF modem development, industrial control systems and signal processing with an established record of developing industrial products and signal processing algorithms.



### DSP Support

Design Answers at Your Fingertips

Get additional information on training, technical documentation and more at: [www.ti.com/dspsupport](http://www.ti.com/dspsupport)

### TI DSP Support

Get to market easily and quickly by leveraging TI DSP support. Customers large and small can access fast and accurate support for their DSP applications. From your personal, on-line “24/7” DSP KnowledgeBase to technical documentation, TI offers the technical support you need when YOU need it. On-line training, webcasts, workshops and the TI Developer Conference provide an array of convenient support choices.

### TI DSP Training Options

## TI Developer Conference

#### TI Developer Conference 2006

See the Future. Create Your Own.

The TI Developer Conference is the premier signal processing event where developers and engineers in industry and academia and their suppliers and partners gather to exchange ideas and discuss industry trends, research, and best practices while obtaining relevant technical training in a hands-on environment. The conference features keynote speakers, hands-on workshops, presentation + demo tutorials and poster sessions in multiple venues around the world including China, Germany, Great Britain, Korea, and the United States.

Topics include:

- Audio
- Control
- Security
- Telecom
- Video
- Hardware
- Software
- Tools Information for Both New and Experienced Users of Signal Processing Applications
- Partner-Specific Sessions for University and Third Party Delegates

#### North America Series

February 28 – March 2, 2006  
Dallas, Texas  
[www.ti.com/tidc06na](http://www.ti.com/tidc06na)

#### Europe Series (includes Israel)

Spring 2006  
[www.ti.com/tidc06europe](http://www.ti.com/tidc06europe)

#### Asia Series

Spring 2006  
[www.ti.com/tidc06asia](http://www.ti.com/tidc06asia)

#### Free On-Line Training

Learn more about how to design your digital signal processing application with self-paced on-line training covering DSP applications, TMS320™ DSPs and easy-to-use software development tools.

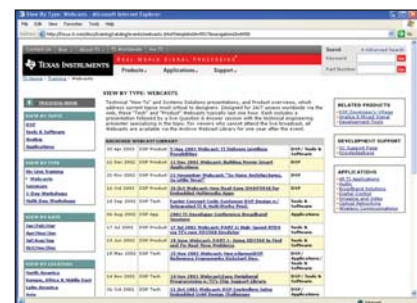


Dozens of courses such as “1-GHz DSP Overview” to “Reference Frameworks for eXpressDSP™ Software” are available today and run from 30 minutes to two hours each.

[www.ti.com/onlinetraining](http://www.ti.com/onlinetraining)

#### DSP Webcasts

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.

[www.ti.com/webcastarchive](http://www.ti.com/webcastarchive)



## Support

### TI DSP On-Line KnowledgeBase

Available 24 hours a day, seven days a week, the TI DSP KnowledgeBase is the industry's most complete on-line resource for DSP questions and project development support. Featuring an easy-to-use, natural-language-based search capability, the DSP KnowledgeBase pulls information from hundreds of thousands of TI DSP content web pages, including technical documentation, giving customers immediate, relevant and focused answers to their search.

[www.ti.com/kbasesg](http://www.ti.com/kbasesg)

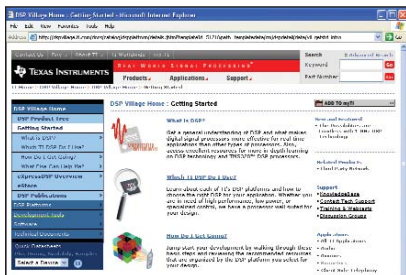
### Technical Documentation

Find complete and easy-to-use data sheets, user's guides and application reports for every TI DSP platform and corresponding DSP software development tools. Easy navigation and search capabilities for more than 3,000 dedicated on-line DSP web pages and more than 100,000 pages of DSP technical documentation.

[www.ti.com/techdocsg](http://www.ti.com/techdocsg)

### Getting Started with TI DSP

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. See page 1 for additional information.

[www.ti.com/gettingstarted](http://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 with a guided tour of eXpressDSP™ Software and Development Tools and a 120-day free evaluation of the Code Composer Studio™ Platinum Edition for the TMS320C2000™, TMS320C5000™, TMS320C6000™ DSP and OMAP™ processor platforms. Order your CD-ROM today at

[www.ti.com/getstartedcd](http://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](http://www.ti.com/discussgroup)

### 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 to be delivered right to your inbox in html or text format.

[www.ti.com/etechsubscribe](http://www.ti.com/etechsubscribe)

#### DSP Applications Journal

To support the design of specific DSP-based systems, view the on-line *DSP Applications Journal* with the latest application notes by platform and software.

[www.ti.com/appsjournal](http://www.ti.com/appsjournal)

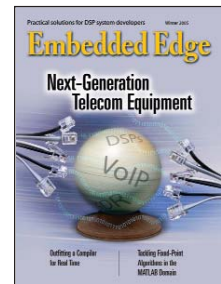
#### Embedded Edge On-Line Magazine

The *Embedded Edge* on-line 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 that will help make life easier as an embedded systems designer.

[www.ti.com/embeddededge](http://www.ti.com/embeddededge)



#### TI Product Information Center (PIC)

Worldwide technical support staff are available to answer questions and troubleshoot problems. Contact the PIC by e-mail or directly by phone. See the worldwide contact information inside the front cover for the e-mail and phone number appropriate to your area.

[www.ti.com/dspsupport](http://www.ti.com/dspsupport)



## Real World Answers – Ask the Experts

System-Level Expertise with the Click of a Mouse

Get answers to your design questions at: [www.ti.com/realworldanswers](http://www.ti.com/realworldanswers)

Save valuable design time and get the answers you need for your current design with the click of a mouse. Texas Instruments offers system-level expertise in a variety of application areas such as: control, telecom, biometrics, video and imaging and more.

Visit [www.ti.com/realworldanswers](http://www.ti.com/realworldanswers) to find helpful information, frequently asked questions and technical documentation for your specific application. Or, “Ask the Expert” and e-mail your design questions. An expert from TI will respond directly back to you.

### Control



TI DSP embedded controllers can help you design power tools with more reliable sensorless control, white goods with higher energy-efficient motors or multi-phase industrial motors with higher resolution and precision. TI's TMS320C2000™ DSP platform provides the ultimate combination of MCU peripheral integration, C efficiency and ease-of-use with the performance of TI DSPs. See how TI DSP embedded controllers can provide your design with more features, better feedback and precision, and reduce costs.

Answers to popular control questions can be viewed at

[www.ti.com/controlanswers](http://www.ti.com/controlanswers)

Or ask the control expert your question at [controlanswers@list.ti.com](mailto:controlanswers@list.ti.com).

### Telecom



TI offers customized telephony products to allow you to get to market faster and easier when developing client-side telephony, embedded modem, remote data collection, Internet connectivity, telephony coprocessing or voiceband processing applications. Using TI's single-source telephony solutions, designers can easily expand product capabilities and feature sets for

telecom applications, as well as customize, adapt and scale the solution to suit particular requirements, allowing designers to focus on end-product differentiation.

Answers to popular telephony questions can be viewed at

[www.ti.com/telephonyanswers](http://www.ti.com/telephonyanswers)

Or ask the telecom expert your question at [telephonyanswers@list.ti.com](mailto:telephonyanswers@list.ti.com).

### Security



With unmatched systems expertise, TI delivers a broad product offering to the security industry, resulting in reduced costs of development and faster time-to-market for customers building security products incorporating biometrics and video surveillance. TI TMS320C6000™ DSPs are used to compress the image in a variety of capable formats, as well as offer the ability to use intelligent image analysis functions and different types of networking protocol support.

Answers to popular security questions can be viewed at

[www.ti.com/securityanswers](http://www.ti.com/securityanswers)

Or ask the security expert your question at [securityanswers@list.ti.com](mailto:securityanswers@list.ti.com).

### Video and Imaging



From portable to plugged applications, TI offers DSP and Analog solutions to fit your video, imaging or multimedia systems design application. TI can help accelerate your design with smarter image processing, more functionality and flexibility that differentiates your product in the marketplace.

TI video and imaging silicon solutions include TI's new TMS320DM64x™ digital media processors, C6000™ and TMS320C5000™ DSPs and OMAP59xx processors. Plus software, developer kits, systems expertise and support are available to accommodate all your needs – no matter what imaging and/or video end equipment is being developed.

Answers to popular video and imaging questions can be viewed at

[www.ti.com/videoimaginganswers](http://www.ti.com/videoimaginganswers)

Or ask the video and imaging expert your question at

[videoimaginganswers@list.ti.com](mailto:videoimaginganswers@list.ti.com).



## Support

### Training Resources

On-Line Training • Webcast Library • One-Day Workshops • Multi-Day Workshops

Get updated information on TI training resources at: [www.ti.com/training](http://www.ti.com/training)

### On-Line Training

A variety of free on-line training courses are available to you at your fingertips 24/7. Learn more about how to design your signal processing application with self-paced on-line training courses covering DSP and Analog applications, easy-

to-use software development tools and more. Check out these new courses:

- Performance, Power, and Price: The Three Ps of Value in Selecting DSPs
- Interfacing Video Decoders with TI's TMS320DM64x™ Processors

- Intelligent Video Surveillance on TI's TMS320DM642 Digital Media Processor
- Complementing DSPs with FPGAs

Visit [www.ti.com/onlinetraining](http://www.ti.com/onlinetraining) for more FREE courses!

### Workshops

TI workshops are a fast and efficient way to learn how to use and implement designs on TI DSPs. The workshops are designed to develop a strong working knowledge of TI DSPs through lectures and practical hands-on exercises. All workshops are facilitated by qualified TI representatives and are based on DSP Starter Kits (DSKs), Evaluation Modules (EVMs) or simulators. We have a range of One-Day, Application, and Multi-Day Workshops.

#### One-Day Workshops

One-day workshops are introductory courses designed to offer product or technology knowledge. These workshops include a significant hands-on section and are ideal introductions to get started with TI DSPs. Visit

[www.ti.com/1dayworkshops](http://www.ti.com/1dayworkshops) for a complete list of courses.

#### TMS320C6416/C6713 DSK One-Day Workshop

- Introduction to TMS320C6000™ DSPs and Code Composer Studio™ IDE
- C6000™ DSP peripherals
- Using the C6000 DSP system tools and software
- Optimizing C6000 DSP code

#### TMS320C5510 DSK One-Day Workshop

- TMS320C5000™ DSP overview
- TMS320C55x™ architecture and peripherals
- Introduction to Code Composer Studio IDE
- Using the C5510 DSP Starter Kit (DSK)
- Use the Chip Support Library to setup and program peripherals
- Analyze and use power-reduction techniques
- Evaluate methods to maximize performance
- Use DSP/BIOS™ kernel and RTA (real-time analysis tools) to build, analyze and debug a system
- Run labs/demos using common real-time applications on hardware (C5510 DSK)

#### TMS320F2812 eZdsp™ One-Day Workshop

- Basic DSP controller implementation
- TMS320F2812 DSP architecture
- How to use PC-based development tools – F2812 eZdsp and Code Composer Studio 2.12 system design

#### Video and Audio Applications Design Hands-On Workshop Based on TMS320DM642 Digital Media Processor

- Getting started on a new video and audio design

- Hardware platform based on DM642 digital media processor
- MPEG-4 technology
- ADPCM audio compression technology
- Digital video security solution on DM642 – video security application example

#### Digital Motor Control One-Day Workshop

- Overview of the synchronous and asynchronous machines
- Compares the field-oriented control with the standard scalar control techniques
- Receive the latest technology and product updates to support your future design
- Learn how the use of DSP processors can lead to the most effective control of your motor

#### DSP/BIOS™ OS One-Day Workshop

- Key elements of a real-time DSP system
- Practical designing and problem solving in multithreaded applications
- Minimizing overhead
- Real-time analysis and debug
- Real-time scheduling and resource management
- Host and target communications



### One-Day Workshops (Continued)

#### Evaluating DSP for Embedded Applications Workshop

- Evaluation of digital signal processors (TMS320C2000™/C5000™/C6000™) alongside other solutions
- Introduction to Code Composer Studio™ (CCStudio), DSP/BIOS™ (real-time O/S) and RTA™ (real-time analysis) tools
- Overview of DSP architecture, performance, code generation tools

- How to achieve high performance via the use of DSPLIB, C compiler/optimizer, third party software
- Introduction to TI's DSP platforms and which applications they support best
- Overview of DSP Starterware and Reference Frameworks (including a demo of RF3)
- Run hands-on labs of simple applications to demonstrate tools features and signal processing concepts

#### Implementation of Video Streaming One-Day Application Workshop

- Imaging applications and video compression standards, streaming protocols overview
- MPEG-4 technology
- MPEG-4 audio and video libraries
- Getting started with a new imaging design
- MPEG-4 audio/video streaming solution – real-time implementation

### Multi-Day Workshops

Three- or four-day, hands-on, advanced, educational courses are highly technical and designed for engineers who want to sharpen their design and development skills. Managed by TI's Technical Training Staff, these workshops include extensive hands-on labs emphasizing the demonstration and application of techniques and skills. Visit

[www.ti.com/multidayworkshops](http://www.ti.com/multidayworkshops) for a complete list of courses.

- Setting up a bootable image in Flash ROM
- Program the DSK on-board Flash memory

#### C6000 DSP Optimization Workshop

- C6000 DSP platform CPU architecture
- C6000 DSP platform CPU pipeline
- Building Code Composer Studio projects
- Exploring C6000 DSP compiler build options
- Writing efficient C code
- Writing optimized standard and linear assembly code
- Mixing C and Assembly language
- Software pipelining techniques
- Numerical issues with fixed-point processors
- Basic C6000 DSP system memory management
- How caches work and optimizing their usage

#### TMS320C55x™ DSP Integration Workshop

- Use Code Composer Studio IDE
- Design a real-time double-buffered, channel-sorted system
- TMS320C5510 DSP Starter Kit (DSK)
- DSP/BIOS kernel
- Debugging with real-time analysis
- Set up peripherals using the Chip Support Library
- Use some of the McBSP serial ports multi-channel features

- Use the DMA auto-initialization feature
- Use eXpressDSP™-compliant algorithms in an application
- Optimize code and memory for the C55x™ DSPs
- C55x DSP system memory management
- HEX500 system memory management
- Use C5510 DSP boot loader
- Program the DSK on-board Flash memory

#### TMS320C54x™ DSP Integration Workshop

- Utilize Code Composer Studio IDE
- Design a real-time, double-buffered, channel-sorted system
- TMS320VC5416 DSP Starter Kit (DSK)
- DSP/BIOS kernel
- Debugging with real-time analysis
- Set up peripherals using the Chip Support Library
- Use some of the McBSP serial ports multi-channel features
- Use the DMA auto-initialization feature
- Use eXpressDSP-compliant algorithms in an application
- Optimize code and memory for the C54x™ DSP
- C54x DSP system memory management
- HEX500 system memory management
- Use VC5416 boot loader
- Program the DSK on-board Flash memory

#### TMS320C6000™ DSP Integration Workshop

- Use Code Composer Studio™ IDE
- Design a real-time double-buffered system
- TMS320C6711 Design Starter Kit (DSK)
- DSP/BIOS™ kernel
- Debugging with real-time analysis
- Set up peripherals using the Chip Support Library
- Discuss the McBSP serial ports multi-channel features
- Use the EDMA advanced features (auto-initialization, interrupt synchronization)
- C6000™ DSP system memory management
- C6000 DSP cache operation
- Design your DSP system to allow code/data overlays in memory
- Evaluate and use C6000 DSP boot loader



## Support

### Multi-Day Workshops (Continued)

#### TMS320C28x™ DSP Workshop

- Evaluate C28x™ DSP ability to meet your system requirements
- Compare/contrast C28x DSP to other solutions you have used or evaluated
- Use development tools to compile, optimize, assemble, link, debug and benchmark code
- Demonstrate a working knowledge of the C28x DSP functional modules
- Demonstrate a working knowledge of the basic operations for the C28x DSP
- Understand where to go to get more information
- Have a full working knowledge of your take-home eZdsp™ board

#### TMS320C24x™ DSP Workshop

- C24x™ DSP architecture and instruction set
- Use of PC-based development tools
- Memory and I/O usage

- Algorithm development
- Basic DSP controller implementation
- Binary arithmetic, scaling, difference equations
- Hardware interface issues

#### DSP/BIOS™ Kernel One-Day Workshop

- Define a real-time system design and its software design challenges
- Apply software development tools in developing a system:
  - Generating and loading software for a specific target
  - Debugging software and visualizing data using breakpoints
  - Visualizing software performance and data during execution using DSP/BIOS kernel
- Integrate system and application software into a real-time design:
  - Interfacing to and configuring DSP/BIOS kernel

- Synchronizing events and access to shared data structures using DSP/BIOS kernel
- Communicating between processes and with peripheral devices using DSP/BIOS kernel

- Analyze and optimize software to meet real-time requirements
  - Analyzing real-time performance of software using DSP/BIOS kernel
  - Calculating and optimizing I/O buffering
  - Optimizing the use of program and data memory

#### Registration

To register for these workshops, please visit

[www.ti.com/multidayworkshops](http://www.ti.com/multidayworkshops)

### TI DSP Webcast Library

The library contains a variety of webcasts ranging from technical “How-Tos” to systems solution presentations and product overviews, which address current topics most critical to designers. Designed for 24/7 access worldwide via the Web, these webcasts typically last one hour. Each includes a presentation followed by a live Question & Answer session with the technical engineering presenter specializing in the topic. To access the library, visit [www.ti.com/webcasts](http://www.ti.com/webcasts)

#### DSP Webcasts

- Easy Peripheral Programming with TI’s Chip Support Library
- Don’t Compromise—DSP Controllers Solve Embedded Control Design Challenges
- Debugging DSP Systems with TI JTAG Emulation

- Maximizing Data Transfer Efficiency with C5000™ DMA Controller
- Getting Started with Code Composer Studio™ IDE Version 2.0
- Utilizing the Two-Level Cache on the TMS320C62x™ / TMS320C67x™ / TMS320C64x™ DSPs in your DSP System
- Flash Programming for TMS320LF240x DSP Digital Control Systems
- Debug C24x DSP Digital Control Design with Real-Time Monitoring
- New TMS320C64x DSPs Revolutionize 3G Wireless
- Flexible System Interfacing with McBSP
- Manage Code Size vs. Code Speed Tradeoffs with Profile-Based Compiler

#### Analog Webcasts

- Analog eLab Webcast
- Controlling Auxiliary Output Voltages with the UCC2540 PWM
- The DC/DC Controller
- Zero Voltage Switching Using the Active Clamp and Reset Technique
- Tendencias en Manejo de Potencia



Texas Instruments DSP device nomenclature includes a Prefix (signifying the device qualification status), the Device Family number (i.e., 320 or 32 for TI DSPs), a Technology symbol, the Device number (typically three to five alpha-numeric characters), a two or three character Package Type code, an optional

Temperature Range character, and the Device Speed Designation. Other variations do exist on a limited basis. See the specific device data sheet for additional information on device nomenclature for that device.

For the most updated information, visit [www.dspvillage.com](http://www.dspvillage.com)

## Typical DSP Device Nomenclature

**TMS 320 C 6416 T GDK ( ) 600**

**Prefix**

- TMX = Experimental device
- TMP = Prototype device
- TMS = Qualified device
- SMJ = MIL-PRF-38535, QML
- SM = High Rel (non-38535)
- OMAP = OMAP
- P = Experimental device (OMAP)

**Device Family**

32 or 320 = TMS320™ DSP family

**Technology**

- C = CMOS
- DM = Digital media
- E = CMOS EPROM
- F = CMOS Flash EEPROM
- LC = Low-voltage CMOS (3.3 V)
- LF = Flash EEPROM (3.3 V)
- UC = Low-voltage CMOS [3 V (1.8-V core)]
- VC = Low-voltage CMOS [3 V (2.5-V core)]

**Device Speed Designation**

**C6000™ DSPs**

150 (150 MHz)	500 (500 MHz)
167 (167 MHz)	600 (600 MHz)
200 (200 MHz)	720 (720 MHz)
233 (233 MHz)	6 (600 MHz)
250 (250 MHz)	7 (720 MHz)
300 (300 MHz)	8 (850 MHz)
400 (400 MHz)	1 (1 GHz)

**Temperature Range**

Blank = 0°C to 90°C, commercial temperature, default for C6000 DSPs

Blank = -40°C to 100°C, default for C54x™ DSPs

A = -40°C to 105°C, extended temperature (C6000 DSPs)

A = -40°C to 85°C, extended temperature (C2000™ DSPs)

H = 0°C to 50°C

L = 0°C to 70°C

M = -55°C to 125°C

S = -55°C to 125°C (C5000 DSPs)

S = -40°C to 125°C (C2000 DSPs)

**Package Type**

FN = 38-lead PLCC	GTS = 288-pin plastic BGA (23 mm <sup>2</sup> )
GDH = 256-pin BGA (17 mm <sup>2</sup> )	GZG = 289-pin MicroStar BGA (12 mm <sup>2</sup> )
GDK = 548-pin plastic BGA (23 mm <sup>2</sup> )	GZZ = 201-pin MicroStar BGA (15 mm <sup>2</sup> )
GDP = 272-pin plastic BGA (27 mm <sup>2</sup> )	PG = 64-pin PQFP (14 × 20 mm)
GDY = 289-pin MicroStar BGA™ (19 mm <sup>2</sup> )	PAG = 64-pin TQFP (10 mm <sup>2</sup> )
GEL = 181-pin PGA	PBK = 128-pin LQFP (14 mm <sup>2</sup> )
GFN = 256-pin plastic BGA (27 mm <sup>2</sup> )	PCM = 144-pin PQFP (28 mm <sup>2</sup> )
GGU = 144-/169-pin MicroStar BGA (12 mm <sup>2</sup> )	PGE = 144-pin LQFP (20 mm <sup>2</sup> )
GGW = 176-/240-pin MicroStar BGA (15 mm <sup>2</sup> )	PGF = 176-pin LQFP (24 mm <sup>2</sup> )
GHH = 179-pin MicroStar BGA (12 mm <sup>2</sup> )	PQ = 132-pin PQFP (24.13 × 27.44 mm)
GHK = 257-/288-pin MicroStar BGA (16 mm <sup>2</sup> )	PYP = 208-pin PowerPAD™ plastic QFP (28 mm <sup>2</sup> )
GJC = 352-pin plastic BGA (35 mm <sup>2</sup> )	PZ = 100-pin LQFP (14 mm <sup>2</sup> )
GJL = 352-pin plastic BGA (27 mm <sup>2</sup> )	RFP = 144-pin PowerPAD plastic QFP (22 mm <sup>2</sup> )
GLS = 384-pin plastic BGA (18 mm <sup>2</sup> )	VF = 32-pin LQFP (7 mm <sup>2</sup> )
GLW = 340-pin plastic BGA (18 mm <sup>2</sup> )	ZDH = 256-pin BGA (17 mm <sup>2</sup> )
GLZ = 532-pin plastic BGA (23 mm <sup>2</sup> )	ZDY = 289-pin MicroStar BGA (19 mm <sup>2</sup> )
GNV = 284-pin plastic BGA (18 mm <sup>2</sup> )	ZZG = 289-pin MicroStar BGA (12 mm <sup>2</sup> )
GNZ = 352-/548-pin plastic BGA (27 mm <sup>2</sup> )	ZTZ = 697-pin BGA (24 mm <sup>2</sup> )
GQW = 143-pin MicroStar Jr. BGA (7 mm <sup>2</sup> )	

**Device Revision**

<b>Device</b>		
<b>C6000 DSPs</b>	<b>C5000 DSPs</b>	<b>C2000 DSPs</b>
6201	6701	240 2801
6202B	6711D	241 2806
6203B	6712D	242 2808
6204	6713B	243 2810
6205	6722	2401A 2811
6211B	6726	2402A 2812
6410	6727	2403A
6412	640	2404A
6413	641	2406A
6414T	642	2407A
6415T	643	
6416T	5416	
6418	54CST	
6455		

For the *actual* device-specific part numbers, see the Product Specification Guides in this document.



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