Texas Instruments

THE WORLD LEADER IN DSP AND ANALOG

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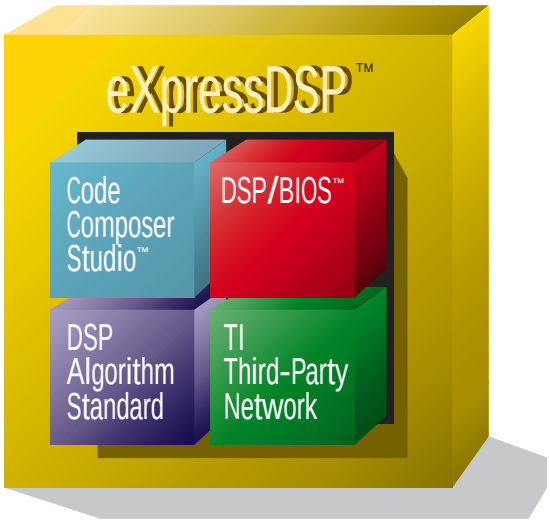
VOL. 1 ■ SEPT./OCT. 1999

technology innovations

NEW TECHNICAL INFORMATION ON TI'S DSP, ANALOG AND LOGIC DEVICES

New DSP software environment



eXpressDSP™ Real-Time Software Technology simplifies and streamlines DSP development

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Amplifiers: Links to the real world

TI supplies a range of amplifiers, including audio power amps and single-supply op amps

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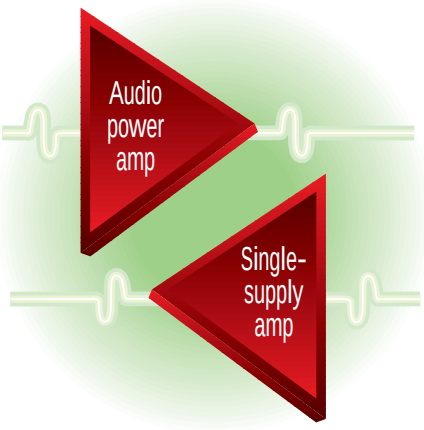

www.ti.com/sc/techinnovations

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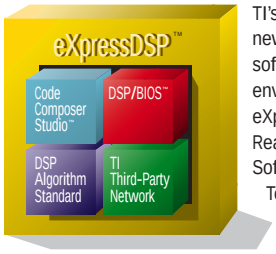
eXpressDSP™



TI's revolutionary new DSP software environment, eXpressDSP™ Real-Time Software Technology takes real-time development to a new level of ease and standardization unmatched in the industry. **Page 4**

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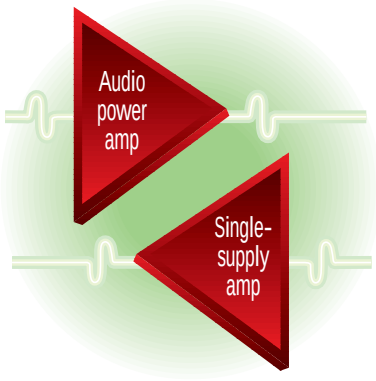
Analog

A wide range of amplifiers

From next-generation audio power amplifiers to single-supply op amps, TI can supply the right amplifier solution, whatever the design needs. **Page 13-16**



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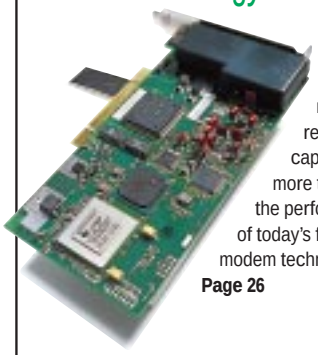
Networking

ADSL technology



TI's ADSL technology delivers a new era of remote access capabilities with more than 100 times the performance of today's fastest analog modem technology. **Page 26**

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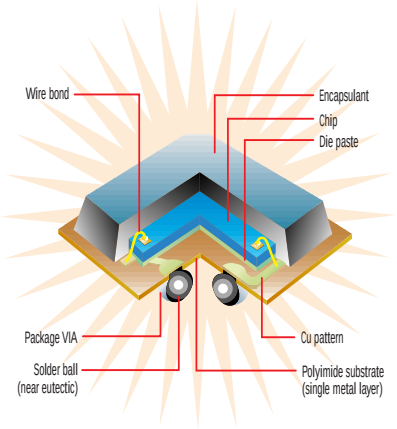
News updates

Logic



MicroStar BGA™

Designers using TI logic products can now enjoy increased signal bit width, reduced board space and enhanced thermal/electrical performance with the 96- and 114-ball MicroStar BGA™.
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Resources

Free seminar series

An upcoming free DSP and analog seminar series from Texas Instruments will allow designers to experience the most advanced techniques for implementing the world's most powerful DSP solutions.
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Welcome to the debut issue of 'Innovations'

Technology Innovations **is TI's new worldwide product magazine for design engineers. We've created this magazine to bring together all of TI's new leadership products in a single resource, with one thing in mind: to make the design process easier for you.**

In response to our research inquiries, you identified some things that are important to you in making your design decisions.

Below are just a few of the ways we've tried to incorporate your suggestions into *Technology Innovations*:

- **A single source for all of TI's new product information**
- **Clearly identified product category sections**
- **Technical information, including application and design support**
- **Easy access to more specific product information via the Internet**
- **Up-to-date lists of available tools and other support materials**

In addition to format improvements, *Technology Innovations* is designed to showcase TI's strong focus on its industry-leading digital and analog products. Texas Instruments is the industry's premier DSP supplier; almost half of all new designs use TI DSPs. In addition, TI is the industry's number one supplier of analog and mixed-signal devices. When combined with TI's flexible software-based platform and the largest network of third-party providers, these elements come together to bring you DSP Solutions.

We hope you find *Technology Innovations* useful and use it often as you design advanced end equipment. Be sure to visit www.ti.com/sc/techinnovations for more specific product information.

Thank you,
Suellen Price, Editor

TI to acquire Unitrode Corporation

Texas Instruments has announced plans to acquire Unitrode Corporation, which offers power management components in power supply control, interface and battery management — technology increasingly critical for portable devices.

These product families will fully complement TI's existing analog catalog selection, thus broadening its offering of high-performance components that can be optimized to operate with TI's DSP portfolio.

Unitrode's leadership, expertise and strong understanding of systems in power supply control and battery management, coupled with TI's strength in programmable DSP, process technology and packaging, will offer customers a complete solution. Equipment manufacturers can expect more advanced products that will continue to improve battery life and system performance while reducing design cycle time. Consumers can expect more efficient products with longer battery time and intelligent controls.

Unitrode's 840 employees will become a part of TI's Advanced Analog Products organization and will continue to operate from Unitrode's New Hampshire headquarters.

DSP

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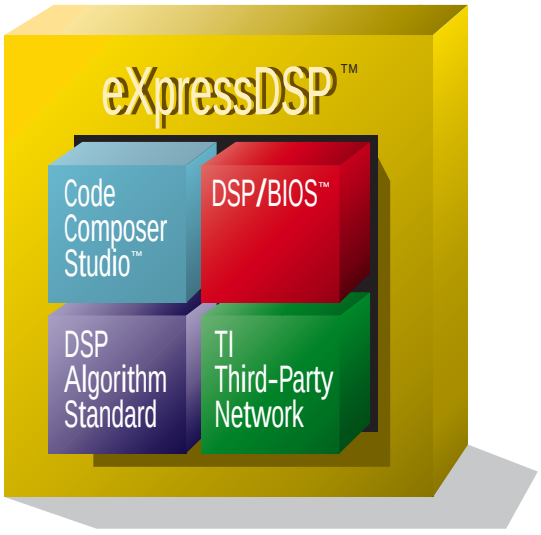
eXpressDSP™ takes real-time DSP development into the eXpress lane

TI's revolutionary DSP software environment, eXpressDSP™ Real-Time Software Technology, was launched in September as a complete, open DSP software environment designed to enable a tenfold increase in DSP applications. TI's software strategy provides an easy-to-use software environment beyond what any other DSP supplier can offer today.

eXpressDSP software technology simplifies and streamlines the DSP product development process and gives original equipment manufacturers (OEMs) a choice of reusable software components such as complex DSP algorithms, enabling them to focus creative energies into engineering the next "must have" product. By taking development to a new level of ease and standardization unmatched in the DSP industry, eXpressDSP is expected to reduce product development time by well above 50 percent depending on the customer's application.

"As the digital revolution progresses, DSPs will continue to proliferate in all facets of our lives," said Lou Santora, vice president engineering, Cisco Systems. "Moving DSP products quickly from concept to market is imperative, and eXpressDSP has the potential to shave countless hours off software development."



OEMs like Cisco create entirely new applications and differentiate existing products by making them feature-rich, faster, smaller and more affordable to consumers. Today's challenge is to quickly and easily create those

applications through software on a programmable DSP. Studies show up to 80 percent of all embedded processor engineering product development costs are related to software, whether it be writing raw code or integrating different pieces of software code to work together in a system. TI designed eXpressDSP to maximize that software investment.

"TI's new eXpressDSP software initiative provides three clear benefits to developers," said Bill Witowsky, chief technical officer and senior vice president, engineering, Telogy Networks. "First, it provides a highly productive development environment for implementing demanding real-time systems. Second, it offers a real-time operating environment to ensure real-time constraints are met. And third, its standardized algorithms make it easier to build complex software systems using solutions from different third-party software developers."

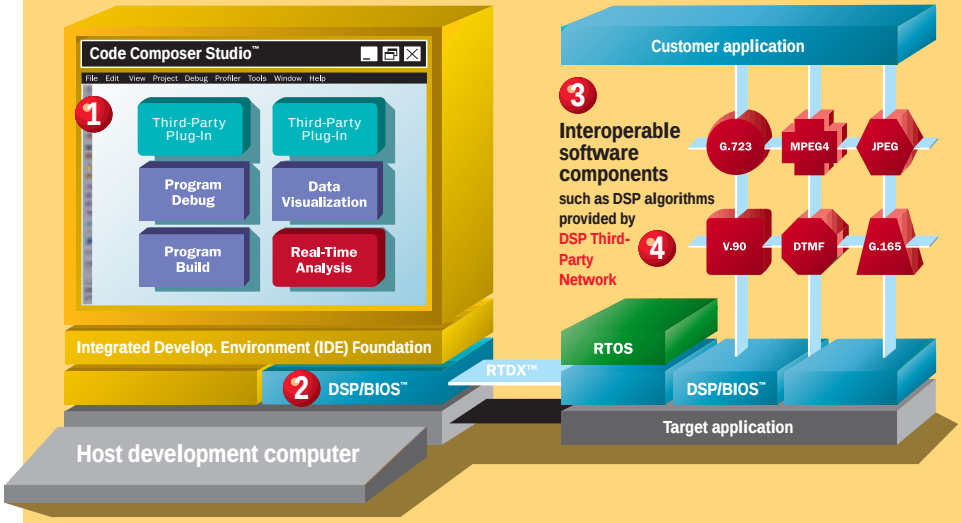
The eXpressDSP environment moves the DSP design effort from a custom-crafted approach to a new buy-versus-make, "configure your own" paradigm through the synergy of four key components *(See package at right)*:

- Code Composer Studio™, the world's most advanced DSP integrated development solution
- A scalable, real-time software foundation in DSP/BIOS™
- Algorithm standards to enable software reuse
- A base of TI DSP third-party software written to standards for easy interoperability

The eXpressDSP real-time software technology will empower OEMs to exploit the power of TI DSPs by accelerating the express delivery of new products and providing the programming ease and interoperability that will enable designers to express themselves through innovative applications. Developers can move to the higher performance points offered by TI's DSPs while being assured of a development environment that helps them focus on their end-products rather than on generating code.

Free demonstration CD-ROM at www.ti.com/sc/techinnovations.

Four components to faster programming



1 Code Composer Studio™ is an open, powerful integrated development environment that uses an intuitive system of advanced development tools that can slash overall DSP coding time and eliminate many real-time problems in minutes. Features include advanced code generation tools and an open architecture for third party plug-in tools that enable developers to customize their environment with specialized toolsets to meet their specific needs.

2 DSP/BIOS™ is a universal layer of scalable, real-time foundation software for TI DSPs that may be imbedded within the target application and provides the basic run-time systems services and integration support needed for all DSP applications.

3 Interoperable software components are based on the DSP Algorithm Standard for application interoperability. This is a DSP first: a single, standard set of coding conventions and application programming interfaces (APIs), so algorithms can be written once by the creator and reused widely by integrators.

The standard includes algorithm programming rules that enable interoperability between different types of algorithms such as JPEG, MP3 or AC-3 Audio Player. TI also will provide tools to assist the developer in creating standardized algorithms.

4 TI DSP third-party network is the world's largest. More than 40 members of TI's third-party network have adopted new eXpressDSP Software Technology. Of those, the following have software product ready today or in development based on eXpressDSP: ADT, Blue Wave Systems, D2 Technologies, DSP Software Engineering, Delphi Communications, Hunt Engineering, Hyperception, Ixthos, Mango Computers, MESi, Momentum Data Systems, Precise Software Technologies, RadiSys, Sipro Lab Telecom, Spectrum Digital, Spectrum Signal Processing and The MathWorks.

eXpressDSP™ components available today

All four components of the eXpressDSP technology are available online at www.ti.com/sc/techinnovations The DSP algorithm standard is available in a developer's kit that includes rules and guidelines, "how to" application notes, tools and a TMS320C6000 demonstration showing algorithm interoperability. DSP/BIOS is included with Code Composer Studio and features no run-time fees.

WHITE PAPER EVALUATION MODULE APP REPORT CD ROM SOFTWARE

Starter kit simplifies TMS320™C6000 design

THE new TMS3206C6211 DSP Starter Kit from Texas Instruments provides system designers with an easy-to-use, cost-effective way to take their high-performance TMS320™C6000 designs from concept to production.

The 'C6211 DSP Starter Kit (DSK) not only provides an introduction to 'C6000 technology, but is also powerful enough to use for fast development of networking, communications, imaging and other applications.

Priced at only $195, the kit comes with an extensive selection of hardware and software, including:

- A 'C6211 DSK board that easily connects to a PC through a parallel port cable
- A 150-MHz 'C6211 DSP
- 4 MBytes of external SDRAM
- 128 KBytes of external flash memory
- TI's TLC320AD535 16-bit data converter
- TI's TPS56100 power management device
- A JTAG controller for easy emulation and debugging
- An expansion daughter card interface for extensible system development
- CE-compliant Universal Power Supply
- TI's highly efficient 'C6000 C compiler and assembly optimizer
- Code Composer debugger
- DSK support software

To purchase the 'C6211 DSK, contact your local TI field sales representative or TI authorized distributor.

One-day workshops offered for 'C6211 DSK users

TI is offering a series of one-day, hands-on workshops for purchasers of the new TMS320C6211 DSP Starter Kit.

The sessions, which will be offered in North America, present engineers and engineering management with a practical introduction to the price- and performance-leading 'C6211 DSP, Code Composer Studio™ integrated-development environment and the 'C6211 DSK. This training is available for only $195 — the standard cost of the 'C6211 DSK alone — a huge value intended to encourage developers to "test drive" these products and tools today. The registration fee includes all training, materials and a 'C6211 DSK.

Facilitated by TI instructors, these workshops feature hands-on, lab-based educational programs. No prior DSP experience is required. For dates, locations and registration information, call 1-800-750-3377, ext. 1999, or visit **www.ti.com/sc/techinnovations**

EVALUATION MODULE APP REPORT PRICING SUGGESTED RESALE PRICE $195.00

App reports

- **G723.1 Dual Rate Speech Coder — Multichannel TMS320C6000 Implementation (SPRA552A):** This application report describes how the G.723.1 Dual Rate Speech Coder has been implemented on the TMS320C6000 DSP. Beyond the use of the TMS320C6000 intrinsic functions, the application report includes specific changes required to allow this coder to operate in a real-time system with other speech coders. Also included are several techniques that can optimize the use of running multiple channels concurrently.

- **A Multichannel/Algorithm Implementation on the TMS320C6000 DSP (SPRA556A):** This application report describes how to build DSP algorithm modules for multichannel applications running on the TMS320C6000 DSP. Also, the basic requirements for multichannel/algorithm implementations (re-entrant and re-locatable) are presented along with practical approaches for multichannel implementation. This document includes example programs to illustrate those approaches.

- **A Multichannel Serial Port Driver Using DMA on the TMS320C6000 DSP (SPRA559A):** This application report presents an implementation of the TMS320C6000 DSP serial port driver. The implementation extracts data from the TDM data stream, saves the data to the individual buffer of each channel and constructs the TDM data stream from individual data buffers.

- **Host-side Design of a Multichannel/ Algorithm System on the TMS320C6000 DSP** (SPRA558A)
- **Target-side Design of a Multichannel/Algorithm System on the TMS320C6000 DSP** (SPRA560A)
- **G.726 ADPCM Speech Coder: Mulitchannel TMS320C6000 Implementation** (SPRA563A)
- **TMS320C6000 Multichannel Vocoder Application Design Kit (ADK)** (SPRA567A)

For a comprehensive collection of TI's latest DSP application notes, which features more than 400 DSP app notes, visit **www.ti.com/sc/techinnovations**

TMS320™C5000 DSPs for power-sensitive apps

Three devices in the industry's most power-efficient generation of DSPs are now either in volume production or sampling for design into power-sensitive applications ranging from hearing aids to multichannel communications. TI's TMS320™C5420, TMS320C5402 and the new TMS320C5409 are specifically designed to meet the demands of extended battery life, miniaturized form factors and low system and operating costs.

TMS320C5420 in production

The 'C5420 is the most highly integrated fixed-point DSP available, answering the performance, power and space needs of carrier class, multichannel infrastructure equipment such as base stations, remote access server modems and computer telephony systems.

With two DSP cores on chip, the 'C5420 delivers 200 million instructions per second (MIPs) of performance while consuming less than 120 mW of power. The device integrates 200K words of RAM, six serial ports, DMA controller and a 16-bit host port interface (HPI), all packaged in a 12 x 12 x 1.4 mm MicroStar BGA™.

TMS320C5402 in production

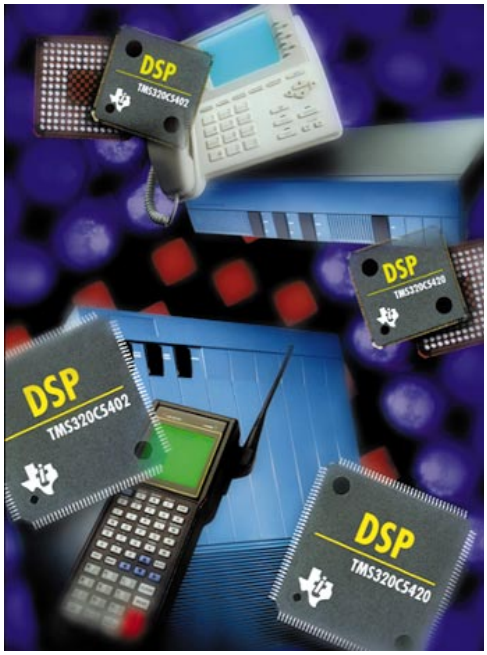
The 'C5402 delivers 100 MIPS at only $5, making it the industry's most cost-effective, general-purpose solution for single-channel, end-user terminals such as wireless modems, next-generation personal digital assistants (PDAs) and Ethernet phones.

Consuming less than 70 mW of power, the new ultra-low-power 'C5402 devices sampling today are well suited for battery-powered personal medical devices such as cochlear implants and hearing aids as well as wireless and telephony devices.

TMS320C5409 sampling

The new 100-MIPS 'C5409 integrates 32K words of SRAM, 16K of ROM, three McBSPs, DMA controller and HPI.

High-performance, low-power consumption and a small form factor make the device well suited for audio and portable consumer applications, wireless and cordless telephones, miniaturized hands-free wireless communications and IP telephones.



App reports

- **TMS320C549 to TMS320C5402 Migration (SPRA575):** This application report describes issues of interest related to migration from TI's TMS320VC549 to the TMS320VC5402. The objective of this application report is to show the differences between the two devices.
- **Bootloading the TMS320C548 Using the BSP in Standard Mode** (SPRA571)
- **Interrupt Handling Using Extended Addressing of the TMS320C54x Family** (SPRA492A)
- **A Practical Application of the TMS320C54x Host Port Interface (HPI)** (SPRA574)

For the comprehensive collection of TI's latest DSP application reports, which features more than 400 DSP app reports, visit **www.ti.com/sc/techinnovations**

TI's TMS320™C54x generation

Device	MIPS	Core voltage	I/O voltage	Status	Package
TMS320VC5420	200	1.8	3.3	Released	144 BGA
TMS320VC5409	100	1.8	3.3	Sampling	144 BGA
	80	1.8	3.3	Sampling	144 BGA
TMS320VC5402	100	1.8	3.3	Released	144 BGA
TMS320UC5402	80	1.8	1.71-3.60	Sampling	144 BGA
TMS320UVC5402	30	1.2	1.14-2.75	Sampling	144 BGA

TI's analog products complement new DSPs

The new TMS320 DSP offerings are easily interfaced with other system components from TI. Among TI's data management solutions that interface directly with 'C54x DSPs are TLV2544 and TLV2548 analog-to-digital converters (ADCs), TLV5633 and TLV5639 digital-to-analog converters (DACs) and TLC320AD535, TLC320AD543 and TLC320AD545 codecs. Power management solutions with outstanding performance include TPS3305 and TPS3307 supervisory circuits and TPS7418 and TPS763xx low dropout (LDO) regulators. A complete list of TI's data converter and power management devices for DSPs is available at www.ti.com/sc/techinnovations Also, see the analog section beginning on page 13.

DATA SHEETS EVALUATION MODULE APP REPORT

App design kits for motor control and UPS

Designers of digital control systems for motors and uninterruptible power supplies (UPS) can rely on new TMS320™C24x application design kits (ADKs) from Texas Instruments to help them develop their products quickly.

The ADKs provide full system designs, including software, application notes, technical documentation, system-level block diagrams and schematics.

Featuring high CPU bandwidth and integrated peripherals, 'C240x/'F240x DSPs provide a single-chip solution for implementing a complete digital control system for motor control and an improved, cost-effective solution for UPS design. Single-cycle instructions make it possible to execute multiple control algorithms at high speeds.

On-chip peripherals specifically chosen for embedded control applications include analog-to-digital converters (ADCs), Event Managers with multiple PWM outputs, Watchdog Timers and serial communications modules such as SCI, CAN and SPI.

The ADKs provide full system designs, including software, application notes, technical documentation, system-level block diagrams and schematics.

Digital control brings the advantages of noise immunity and the elimination of redundant voltage and current sensors. DSP programmability makes it easy to update systems and offers enhanced algorithms for improved reliability. All of these features help reduce system costs and accelerate the development process.

The 'C24x ADK for control of a 3-phase permanent magnet synchronous (PMSM) motor uses field-oriented control (FOC) methods and includes a Visual Basic graphics user interface (GUI). The 'C24x ADK for closed-loop control of a triple-conversion online UPS system provides output that can be observed using an oscilloscope.

Software for both ADKs was developed using the TMS320™F24x evaluation module (EVM). Included in the ADKs is source code, an 'F24x EVM linker command file, application notes and other documentation.

The 'C24x ADKs are available online at **www.ti.com/sc/techinnovations**

DATA SHEETS EVALUATION MODULE APP REPORT

Digital innovations

First solution for secure music downloads

Four companies, including Texas Instruments, have teamed up to offer the first complete solution for securely downloading music off the Internet onto portable audio players.

Using leading technology from TI, Liquid Audio Inc., the Fraunhofer Institute for Integrated Circuits and SanDisk Corp., this is the first programmable DSP-based solution to meet the new Secure Digital Music Initiative (SDMI) guidelines for digital music portable devices.

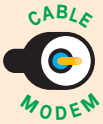
The openly licensable security solution is based on TI's programmable low-power DSPs, Liquid Audio's secure portable player platform (SP3) and Fraunhofer IIS-A's audio codecs. It improves the consumer experience for digital music and enables interoperability among secure portable music devices.

SDMI's guidelines will enable a consumer-focused solution for delivering music to portable devices. The SDMI is seeking to stop the unauthorized copying and downloading of music off the Internet by building security measures such as watermarking, encryption and decryption into compact discs, electronic music distribution (EMD), personal computer hosts and portable players.

TI will provide DSPs and a complete library of software decoders. Liquid Audio offers the software and services for secure digital delivery, download and portability of music. Fraunhofer IIS-A developed the popular MP3 and AAC audio compression formats within the collaborative work of MPEG, and SanDisk produces the flash memory cards used in the portable players.

The programmable DSP-based solution is available today to enable manufacturers to develop secure players in time for Christmas 1999.

TI puts the 'voice' in cable modems



Texas Instruments recently announced the acquisition of Libit Signal Processing Ltd., a technology leader in silicon solutions for the fast-growing cable-access equipment market. This acquisition expands TI's leadership in DSP and analog technologies into all segments of the broadband communication market, including xDSL and cable.

While rapid technological change in the cable industry has cable system operators racing to provide cable telephony services as a "last mile" solution, TI aims to deliver total quality telephony services. This requires complex, system level software and complete silicon solutions. Libit designs, develops and manufactures such highly integrated silicon solutions for cable broadband access.

By combining the power of its market-leading programmable DSPs with the integrated silicon solutions and Internet telephony software of Libit and Telogy (another recently announced acquisition), TI gains the technology to offer a complete solution to cable equipment manufacturers and their service provider customers. This combination will improve quality of service and make communications faster, simpler and more cost effective.

■ **Solutions for digital innovations can be found at www.ti.com/sc/techninnovations**

DSP tools

To order any of these DSP tools, contact your local TI sales office or authorized distributor. See regional listings on page 31.

TMS320™C6000 development tools/technical documentation

Description	Device	Technical documentation	Lit. No.	U.S. $ [1]
EVALUATION MODULES (EVMS)				
'C62x EVM	TMDS3260A6201	EVM User's Guide	SPRU269	$995
		EVM Technical Reference	SPRU305	
'C62x EVM Bundle[2]	TMDS326006201	EVM User's Guide	SPRU269	$1,995
		EVM Technical Reference	SPRU305	
'C67x EVM	TMDX3260A6701	EVM User's Guide	SPRU269	$1,495
		EVM Technical Reference	SPRU305	
'C67x EVM Bundle[2]	TMDX326006701	EVM User's Guide	SPRU269	$2,495
		EVM Technical Reference	SPRU305	
'C62x Multichannel EVM Bundle[2]	TMDX3260M6201	Multichannel EVM User's Guide	SPRU285	$3,995
		Multichannel EVM Ref. Guide	SPRU308	
SOFTWARE DEVELOPMENT TOOLS				
Code Composer Studio	TMDX324685C-07	Win 95/98/NT		$2,995
■ CC IDE		'C6000 Software Tools	SPRU185	
■ Simulator		'C6000 Programmers Guide	SPRU198	
■ Code Gen Tools		'C6000 Assy. Lang. Tools Guide	SPRU186	
■ DSP/BIOS/RTDX		'C6000 C Compiler User's Guide	SPRU187	
■ Emulation SW		Code Comp. Studio User's Guide	SPRU328	
		Code Composer Studio Tutorial	SPRU301	
Code Composer Studio	TMDX3246855-07	Win 95/98/NT		$1,495
■ Compile Tools		'C6000 Software Tools	SPRU185	
■ CC IDE		'C6000 Programmers Guide	SPRU198	
■ Simulator		'C6000 Assy. Lang. Tools Guide	SPRU186	
■ Code Gen Tools		'C6000 C Compiler User's Guide	SPRU187	
■ DSP/BIOS/RTDX		Code Comp. Studio User's Guide	SPRU328	
		Code Composer Studio Tutorial	SPRU301	
Code Composer Studio	TMDX3240160-07	Win 95/98/NT		$1,995
■ Debug Tools		'C6000 Software Tools	SPRU185	
■ CC IDE		'C6000 Programmers Guide	SPRU198	
■ DSP/BIOS/RTDX		'C6000 Assy. Lang. Tools Guide	SPRU186	
■ Emulation SW		'C6000 C Compiler User's Guide	SPRU187	
		Code Comp. Studio User's Guide	SPRU328	
		Code Composer Studio Tutorial	SPRU301	
JTAG Emulator	TMDS00510	XDS510 Emul. (ISA) &JTAG Cable	—	$4,000
	TMDS00510WS	XDS510 Emul. (SCSI) &JTAGCable	—	$6,000

TMS320™C5000 development tools/technical documentation

EVALUATION MODULES				
'C5402 DSK (DSP Starter Kit)	TMDX320005402	—		$1,995[3]
'C5410 EVM Kit[2]	TMDX326005410	—		$1,995[3]
'C549 SD EVM Bundle[2]	TMDS3P603120	—		$2,995[3]
'C5410 SD EVM Bundle[2]	TMDS3P603121	—		$2,995[3]
SOFTWARE DEVELOPMENT TOOLS				
'C5000 Code Composer Studio™	**TMDS324L85C-07 — Win 95/98/NT**			$2,995[3]
■ CC IDE				
■ Simulator		'C54x DSP Reference Set	SPRU131, SPRU172, SPRU173, SPRU179C	
■ Code Gen Tools		'C54x Assy. Lang. Tools Guide	SPRU102	
■ Emulation SW		Code Comp. Studio User's Guide	SPRU328	
		Code Comp. Studio Tutorial	SPRU327	
		'C54x DSP/BIOS User's Guide	SPRU326	
'C5000 Code Composer Studio	**TMDS324L855-07 — Win 95/98/NT**			$1,495[3]
■ Compile Tools				
■ CC IDE		'C54x DSP Reference Set	SPRU131, SPRU172, SPRU173, SPRU179C	
■ Simulator		'C54x Assy. Lang. Tools Guide	SPRU102	
■ Code Gen Tools		'C54x C Compiler User's Guide	SPRU103	
■ DSP/BIOS/RTDX		Code Comp. Studio User's Guide	SPRU328	
		Code Comp. Studio Tutorial	SPRU327	
		'C54x DSP/BIOS User's Guide	SPRU326	
'C5000 Code Composer Studio	**TMDS32401L0 — Win 95/98/NT**			$1,995[3]
■ Debug Tools				
■ CC IDE		'C54x DSP Reference Set	SPRU131, SPRU172, SPRU173, SPRU179C	
■ DSP/BIOS/RTDX		'C54x Assy. Lang. Tools Guide	SPRU102	
■ XDS510 Emulation SW		'C54x C Compiler User's Guide	SPRU103	
		Code Comp.Studio User's Guide	SPRU328	
		Code Composer Studio Tutorial	SPRU327	
		'C54x DSP/BIOS User's Guide	SPRU326	
'C5000 Visual Linker Code Comp. Studio Plug-in			SPRC031	Free[3]
'C5000 Code Comp. Studio 30-Day Free Eval. Tools			SPRC022	Free[3]
'C5000 Compiler/Assembler/Linker	TMDS324L555-09	Solaris 2.5/HP-UX 10.2		$3,495
'C5000 HLL TI C Source Debugger	TMDS32406L0	Solaris 2.5/HP-UX 10.2		$3,995
'C5000 HLL TI Simulator	TMDS324L551-09	Solaris 2.5/HP-UX 10.2		$2,995
JTAG EMULATOR				
XDS510 Emul. (ISA), JTAG Cable	TMDS00510			$4,000
XDS510 Emul. (SCSI), JTAGCable	TMDS00510WS			$6,000

TMS320™C54x development tools/technical documentation

DSP STARTER KIT (DSK)				
DSK Plus	TMDS32000LO	TMS320C54x DSK Plus User's Guide	SPRU191	$149
EVALUATION MODULES				
'C54x EVM Card: IBM PC-DOS, WIN	TMDS3260051	TMS320C54x EVM Tech. Reference	SPRU135	$995
'C549 EVM Bundle incl. XDS510PP and Asm/Lnk	TMDS3P603120	—	—	$1,995
'C5410 EVM Bundle incl. XDS510PP and Asm/Lnk	TMDS3P603121	—	—	$1,995
CODE GENERATION TOOLS				
'C54x Asm/Lnk for PC	TMDS324L850-02	'C54x Assy. Lang. Tools User's Guide	SPRU102	$250
'C54x C Cmp/Asm/Lnk for PC	TMDS324L855-02	'C54x Opt. C Compiler User's Guide	SPRU103	$1,495
		'C54x Assy. Lang. Tools User's Guide	SPRU102	
'C54x SUNSPARC C Cmp/Asm/Lnk	TMDS324L555-09	'C54x Opt. C Compiler User's Guide	SPRU103	$3,495
		'C54x Assy. Lang. Tools User's Guide	SPRU102	
SIMULATOR SOFTWARE				
'C54x Code Comp. Simulator: PC	CCSIM54XWIN	Code Composer User's Guide	SPRU296	$995
'C54x PC/DOS & WIN Simulator	TMDS324L851-02	'C54x Simul. Getting Started Guide	SPRU137	$495
'C54x SUN SPARC Simulator	TMDS324L551-09	'C54x Simul. Getting Started Guide	SPRU137	$2,995
DEBUGGER SOFTWARE				
'C54x Code Composer (IDE)	CCMSP54XWIN	Code Composer User's Guide	SPRU296	$1,995
'C54x XDS510 C Source Debug: PC	TMDS32401L0	'C54x C Source Debug. User's Guide	SPRU099	$1,995
'C54x XDS510 C Source Debug: SPARC	TMDS32406L0			$3,995
JTAG EMULATOR				
XDS510 Board (ISA), JTAG Cable	TMDS00510	—	—	$4,000
XDS510WS Control. Box, JTAG Cable	TMDS00510WS	—	—	$6,000

TMS320™C3x development tools/technical documentation

DSP STARTER KIT (DSK)				
'C31 DSP Starter Kit	TMDS3200031	'C3x DSK User's Guide	SPRU163	$99
EVALUATION MODULE				
'C30 EVM Card for IBM PC-DOS, Win	TMDS3260030	'C3x Source Debug. User's Guide	SPRU053	$995
Appl. Library Asm/Lnk & HLL Debug	—	TMS320C3x EVM Tech. Reference	SPRU079	—
		TMS320C30 EVM Application Notes	SPRA021	—
CODE GENERATION TOOLS				
'C3x/'C4x PC-DOS, OS/2, Asm/Lnk	TMDS3243850-02	'C3x Periph. Ctrl. Library Guide	SPRU086	$250
'C3x/'C4x PC-DOS,OS/2 C Cmp/Asm/Lnk	TMDS3243855-02	TMDS324 F/P DSP: Optimizing C Comp User's Guide	SPRU034	$750
'C3x/'C4x SUN SPARC C Cmp/Asm/Lnk	TMDS3243555-08	Float.-Pt. Assy. Lang. Tools Guide	SPRU035	$1,125
SIMULATOR SOFTWARE				
Code Composer Simulator	CCSIM3XWIN	Code Composer User's Guide	SPRU296	$495
'C3x PC/DOS & WIN Simul. w/ Debug.	TMDS3243851-02	TMS320C3x Simul. Getting Started	SPRU123	$250
'C3x SUN SPARC Simul. w/ Debug.	TMDS3243551-09	Getting Started Guide for the TMS320 Code Gen. Tools	SPRU119	$495
DEBUGGER SOFTWARE				
Code Composer: 'C3x/'C4x	CCMSP34XWIN	Code Composer User's Guide	SPRU296	$995
'C3x XDS510 C Source Debug.: PC	TMDS3240130	'C3x C Source Debug. User's Guide	SPRU053	$995
'C3x XDS510 C Source Debug.: SPARC	TMDS3240630	—	—	$1,495
JTAG EMULATOR				
XDS510 Board and MPSD cable	TMDS00510M	—	—	$4,000
XDS510WS Control. Box, MPSD cable	TMDS00510WSM	—	—	$6,000
CONVERSION CABLE				
'C3x 3V/5V PC/SPARC Emul. cable (MPSD)	TMDS3080004	—	—	$1,000
JTAG cable (for 'C33 customers)	TMDS3080002	—	—	$495

TMS320™C24x development tools/technical documentation

DEVELOPMENT BOARDS				
'F240 Motion Control Kit (MCK)	TMDS3PMCK240			$995
'F243 DSPStarter Kit (DSK) w/ Code Explorer, avail. 8/1/99	—	—	—	—
EVALUATION MODULES				
'F240 EVM (EVM) w/ Asm/Lnk, XDS510PP and TIHLLDebugger	TMDX326P124X	'C24x EVM Product Bulletin	SPRT150	$1,495
		'C24x DSP Controllers Evaluation	SPRU248	—
'F243 EVM (EVM) w/ C Comp/ Asm/Lnk and XDS510PP, CC 3.05	TMDS3P604030			$2,995
CODE GENERATION TOOLS				
'C1x/'C2x/'C20x/'C24x/ 'C5x Assembler/Linker	TMDS3242850-02	'C1x/C20x/C24x/C5x Assy. Lang.	SPRU018	$250
'C2x/'C20x/'C24x/'C5x C Compiler/Assembler/Linker	TMDS3242855-02	'C2x/C20x/C24x/C5x Opt. C Comp. User's Guide	SPRU024	$750
SIMULATOR SOFTWARE				
Code Comp. 'C20x/'C24x Simulator	CCSIM2XXWIN	Code Composer User's Guide	SPRU296	$1,000
TI 'C20x/'C24x Simulator	TMDX324X851-02	'C20x/C24x Simul. Get Started Guide	SPRU176	$250
DEBUGGER SOFTWARE				
Code Composer Debugger	CCMSP5XWIN	Code Composer User's Guide	SPRU296	$2,000
TIHLL (C Source) Debugger	TMDX324012XX	'C20x/C24x C Source Debugger U.G.	SPRU151	$995
JTAG EMULATOR				
XDS510 Board w/ JTAG cable	TMDS00510	'C20x/C24x C Source Debugger U.G.	SPRU151	$4,000
XDS510PP (Parallel Port) Pod w/ JTAGcable	TMDS00510PP	—	—	$1,500

TMS320™C20x development tools/technical documentation

EVALUATION MODULES				
Spectrum Digital 'C203 EVM Kit	TMDSP632606741	—	—	$895
CODE GENERATION TOOLS				
C Compiler/Assembler/Linker: PC	TMDS3242855-02	'C2x/C20x/C24x/C5x Optimizing C Compiler User's Guide	SPRU024	$750
Assembler/Linker: PC	TMDS3242850-02	'C1x/'C2x/'C20x/'C24x/'C5x Assy. Language Tools User's Guide	SPRU018	$250
C Compiler/Asm/Linker: Sun, SPARC	TMDS3242555-08			$1,125
SIMULATOR SOFTWARE				
Code Composer Simulator	CCSIM2XXWIN	Code Composer User's Guide	SPRU296	$1,000
Simulator: PC	TMDX324X851-02	—	—	$250
Simulator: SPARC	TMDX324X551-09	—	—	$495
DEBUGGER SOFTWARE				
Code Composer Debugger/IDE	CCMSP5XWIN	Code Composer User's Guide	SPRU296	$2,000
XDS510 C Source Debugger: PC	TMDX324012XX	C Source Debugger User's Guide	SPRU151	$995
XDS510 C Source Debugger: SPARC	TMDX324062XX	—	—	$1,495
JTAG EMULATOR				
XDS510 Board (ISA) and JTAG cable	TMDS00510	—	—	$4,000
XDS510WS Control. Box, JTAG cable	TMDS00510WS	—	—	$6,000

[1] Prices are quoted in U.S. dollars and represent 1999 suggested resale pricing
[2] Includes Code Composer Studio — Compile Tools and an EVM specific debugger
[3] Available 4Q99

Third-party hardware & software

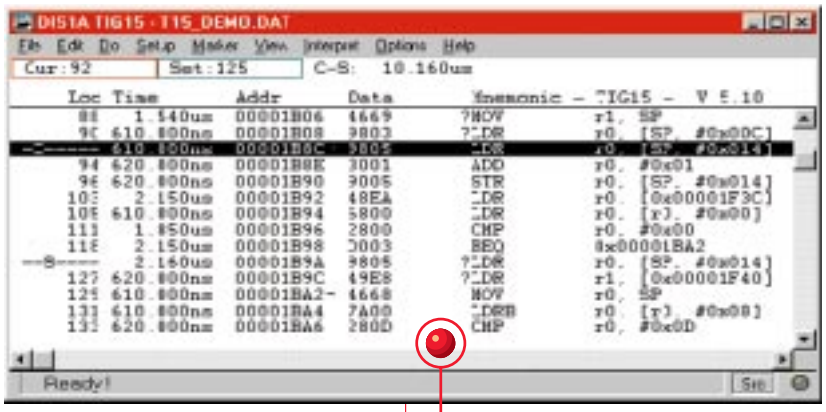
New development & application support available through TMS320™ third parties

Precise provides integrated support for TI DSPs

Precise Software Technologies Inc. provides support for many TI DSPs through its offerings of Precise Solution, Precise/MQX and Precise/RTCS, its embedded TCP/IP stack. For the TMS320™C54x, the Precise/RTCS and its RTOS support deliver an embedded software solution for networking and data communications applications requiring TCP/IP, PPP, DHCP, Bootp, SNMP, HTTP, SMTP and POP3 functionality. For the TMS320C6701 DSP, the offerings of Precise Solution, Precise/MQX and Precise/RTCS can provide integrated support. Precise Solution also supports the TMS320C6211.

Pricing for one license of the Precise/MQX RTOS and Precise/RTCS for the design and development of a single project starts at US $30,000. Availability of Precise/MQX and Precise/RTCS for the 'C6211 and the 'C6701 will be in 4Q99, while the offering for the 'C549 is available today.

■ **Precise Software Technologies Inc.**
Phone: 800-265-9833
e-mail: sales@psti.com
www.psti.com



ComStruct DSP building blocks revolutionize telecommunications systems development

Blue Wave Systems' ComStruct™ line is a modular approach to building a telecommunications system. Based on open standards, fully customizable, flexible and upgradeable in the network, ComStruct enables designers to develop a fully integrated communications system up to 80 percent faster than before.

Three building blocks form ComStruct: the DSP and I/O hardware, FACT™ (Blue Wave's eXpressDSP™-compliant Framework Architecture for Communication Technologies) and application-specific DSP algorithms. Users can incorporate third-party hardware and software, thus protecting investments in other technologies. Dedicated PCI (PCI/C6400), Compact PCI (CPCI/C6400, CPCI/C6402) and VME (VME/C6420) DSP boards based on TI's advanced 'C6000 platform of fixed and floating-point DSPs comprise the DSP hardware platforms. ComStruct is now available with additions planned for release into the year 2000.

■ **Blue Wave Systems Inc.**
Phone: +44-0-1509-634444
e-mail: sales@bluews.com
www.bluews.com

New tools from dli support development of TI GSM BaseBand 1.5 Microcontroller-based systems

dli now offers disassembler and high level language support for designers of systems based on TI's GSM BaseBand 1.5 Microcontroller using dli's Logic Analyzer Systems Personal Line and proLine.

Standard support covers the GSM BaseBand 1.5 with 32-bit (ARM) and 16-bit (Thumb) instruction sets. The disassembler supports data recording with both Processor MClk and the Logic Analyzer's internal clock concurrently. This feature enables simultaneous timing and state analysis. dli's high level language support provides source code debugging of application programs. This support includes enabling a breakpoint/trigger of the Logic Analyzer on a source line and correlating the real-time trace recorded by the Logic Analyzer with the source code.

The disassembler is priced at US $1,500, the high level language support at US $2,500.

■ **dli**
Phone: +49-6074-4002-0
e-mail: sales@dli.de
www.dli.de

Direct board-to-board connection made easier with new Pentek solutions

Pentek now offers the industry's broadest selection of front panel data port (FPDP) solutions for high-speed, real-time TMS320C6000 embedded applications. With these new FPDP 160-Mbps interfaces, direct board-to-board connections between multi-vendor processor boards, high-speed peripherals and fast memory boards have never been easier.

Single-slot 6U VME boards introduced by Pentek with FPDP include:

- Three dual-channel, high-speed, analog-to-digital converters (ADCs) offering 12- or 14-bit resolution and sampling rates from 10 to 40 MHz
- Four narrowband, multichannel digital receiver boards with 2 or 4 inputs, ideal for modem modulation schemes, signal intelligence, cellular base stations, frequency-division multiplexed communications systems and analysis of many forms of radar signals
- A buffer memory board featuring up to 512 MB of memory with digital I/O data rates up to 140 Mbps

Prices for these new FPDP products range from US $995 to US $12,995.

- **Pentek Inc.**
  Phone: (201) 818-5900
  email: news@pentek.com
  www.pentek.com

RIDE 4.2 increases algorithm performance

Hyperception Inc. has released the latest version of its popular Hypersignal RIDE component-based design software. This tool provides an incredibly efficient means of real-time DSP programming, without the user having to write any code at all.

RIDE 4.2 provides increased functionality and introduces blazingly fast Native block component support to provide increased algorithm performance. RIDE allows DSP implementations to be built-up quickly on TI DSPs, including the 'C3x, 'C4x, 'C62x, 'C67x and 'F24x devices. RIDE 4.2 is available in several editions: Standard (US $3,995), Professional (US $4,995) and Enterprise (US $9,995).

- **Hyperception Inc.**
  Phone: 214-343-8525
  e-mail: sales@hyperception.com
  www.hyperception.com

SigC54x provides scalable solutions for wireless and Internet applications

SigC54x multiprocessor DSP modules from Signalogic pack up to 2400 MIPs and 12 TI 'C54x DSP devices into very small form-factors. These modules support TI's 'C549, 'C5410 and 'C5420 devices, as well as SODIMM (2.5" x 1.25") and SIMM (4.75" x 1") form factors.

Signalogic's telecom clients use the SigC54x modules to provide scalable solutions for wireless infrastructure and Internet communications and routing applications. The modules are fully supported by Signalogic's off-the-shelf development tools, including MATLAB interface, visual signal flow diagram and real-time code generator for 'C54x devices. Available now; the single quantity price for the 3-processor, 100-MHz, 384k 16 SigC549-SODIMM module is US $695.

- **Signalogic Inc.**
  Phone: 800-DSPower
  e-mail: dspinfo@signalogic.com
  www.signalogic.com

Debugging breakthrough for heterogeneous processors

Allant Software recently introduced ASPEX, a breakthrough in mixed architecture debugging. ASPEX debugs systems that incorporate heterogeneous processors from TI including the 'C6000, 'C5000, 'C2000 and ARM7 DSPs.

ASPEX supports C++, C and assembly level debugging and provides seamless integration with TI code generation tools. The tool debugs mixed processors on the same JTAG scan path and supports emulators from the industry leaders. Available now, ASPEX has a list price on Windows 9x/NT of US $3,000 for the first target and $2,000 for each additional target.

- **Allant Software**
  Phone: 925-944-9690
  e-mail: sales@allant.com
  www.allant.com

SatPlex/2 Multiplexer System incorporates DSPSE voice, fax and data relay technology

DNE Technologies Inc. has incorporated DSP Software Engineering's (DSPSE) voice, fax and data relay (VFDR) technology on its SatPlex/2 Multi-plexer system. This new system features quality multi-rate voice, fax and data modem support with full-POTS and digital voice connections, allowing easy interface with existing networks.

DSPSE's VFDR is the cornerstone DSP software for applications such as Voice-over-Internet Protocol (VoIP), Voice over frame relay (VoFR), wireless local loop (WLL) and satellite network applications. To accelerate integration, the VFDR software solution is a table-based architecture that is easily modified to address the needs of either single-channel or multichannel applications on any TI TMS320C5000 family member. The software runs on top of TI's DSP/BIOS™ for ease of development and integration in customers systems. DSPSE now has VFDR software available with versions of the code designed specifically for multichannel VoIP on the TMS320C5420. The source licensing fees start at US $150,000.

- **DNE Technologies Inc.**
  Phone: 800-370-4485
  e-mail: info@dne.com
  www.dnetech.com
- **DSP Software Engineering Inc.**
  Phone: (781) 275-3733
  e-mail: info@dspse.com
  www.dspse.com

Continued on page 12

Continued from page 11

QD6x from Sundance enables truly distributed DSP processing

Sundance Multiprocessor Technology Ltd has launched the QD6x, a scalable multiprocessor system based on the latest high-performance DSPs from TI. The PCI card is based on the TI module standard, hosts up to four 'C6000 DSPs with 128 MB of on-board memory and enables a truly distributed DSP-processing system.

The modular design supports the 'C6201, 'C6701, 'C6202 and other TI DSPs. The system features the 'Sundance Digital Bus' for high-speed, hardware linking to data acquisition and image processing modules already on the market. QD6x is supported by industry-standard software from leading suppliers and enables families of DSPs to be mixed to achieve optimized performance and to protect silicon investment.

Shipping now, the QD6x system is available in volume pricing from US $4,000. Source and object code licenses for the G.723.1 vocoder, including full documentation, are available for US $50,000.

■ **Sundance Multiprocessor Technology Ltd.**
Phone: 702-337-1465
e-mail: sundance-dsp@sundance.com
www.sundance.com

Voice Stream vocoder powers up multichannel applications

Adaptive Digital Technologies Inc. (ADT) recently introduced its Voice Stream vocoder software package for the TI 'C54x DSPs. The software package bundles the ITU G.729/G.729A/G.729B, G.723.1 and G.726 vocoders with a G.165 compliant echo canceller and a robust DTMF tone bypass module. Applications for this software package include wireless, satellite and cable telephony, as well as VoIP and multimedia.

Voice Stream is available as a turnkey chip solution or as a linkable object library for applications that require the DSP to be shared with host software. The vocoder is designed to handle multichannel applications. The object library functions are re-entrant and C-callable, making them easy to integrate into host software.

Voice Stream is available now for US $100,000.

■ **Adaptive Digital Technologies Inc.**
Phone: 610-825-0182
e-mail: info@adt-inc.com
www.adt-inc.com

CMX releases real-time multi-tasking operating system for TI TMS320™C54x DSPs

CMX Company recently ported its CMX-RTX™ Real-Time Multi-Tasking Operating System (RTOS) to the TI 'C54x DSP family, including all derivatives. The CMX-RTX RTOS features compact, flexible, robust and ROMable code that enables fast context switching and low interrupt latency times. It also comes equipped with the powerful CMX Function library with more than 70 kernel services and complete, royalty-free source code.

The CMX-RTX RTOS requires only minimal amounts of ROM and RAM. Using TI's development toolset, the CMX-RTX RTOS requires only 3,146 words for the CMX Function Library, 692 words for the CMX Initialize Module and 292 words for the CMX Assembly coded scheduler and interrupt handler. CMX-RTX offers a minimum context switching time of 1.73 µs and maximum interrupt latency time of 800 µs when operating at 100 MHz.

Pricing is based on per seat license, with no royalties and no limit on the number of products that can use the RTOS without any additional fees. The first seat license is US $4,000, with each additional seat license at US $2,600.

■ **CMX Company**
Phone: 508-872-7675
Email: cmx@cmx.com
www.cmx.com

Libraries from Sinectonalysis accelerate development of TMS320™C6000 applications

Sinectonalysis Inc. is now shipping copies of its latest products, the DSP/Veclib (DSP and vector operations), CeisPack (Eigen value/vector problems), CBLAS 123 (basic linear algebra subroutines), ClinPack (linear equations solvers) and EyeLib (image processing) libraries. The routines of these libraries provide algorithm-level optimized performance for initial development while the full course of assembler optimizations is conducted. The extensive set of software libraries perform a multitude of DSP operations and image-processing tasks and have been written to handle a wide variety of matrices, including triangular, banded, Hermitian and Toeplitz.

The current version of the software supports TI's 'C62x and 'C67x DSP chips. Prices for the new libraries range from US $5,000 to US $7,000.

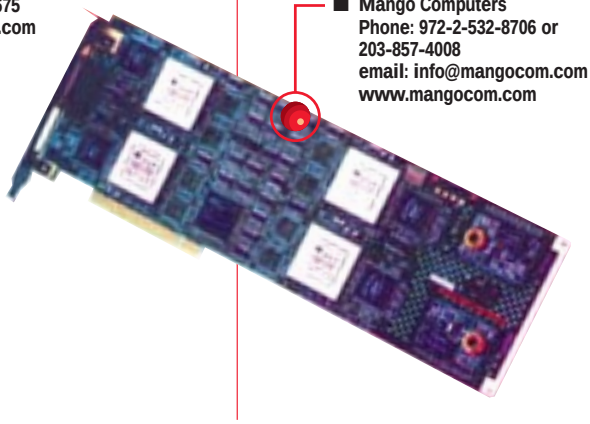
■ **Sinectonalysis Inc.**
Phone: 775-345-0148
e-mail: sinecto@clark.net
www.clark.net/pub/sinecto/index.html

Hawk-PCI breakthrough multiprocessing architecture optimizes power, throughput

Mango Computers announces the launch of its Hawk-PCI™ board, an outstanding four-DSP solution offering more than 4 Gflops of processing power. Based on TI's 'C6701 DSP, the Hawk-PCI represents a breakthrough multiprocessing architecture that optimizes both power and throughput.

The board uses a standard PCI slot and is engineered to be configured seamlessly with any one of Mango Computers' code-generation tools, including Math-Link EDS™-an advanced development environment that incorporates MATLAB commands. The Hawk-PCI is available in the basic configuration for US $8,500.

■ **Mango Computers**
Phone: 972-2-532-8706 or 203-857-4008
email: info@mangocom.com
www.mangocom.com



Analog

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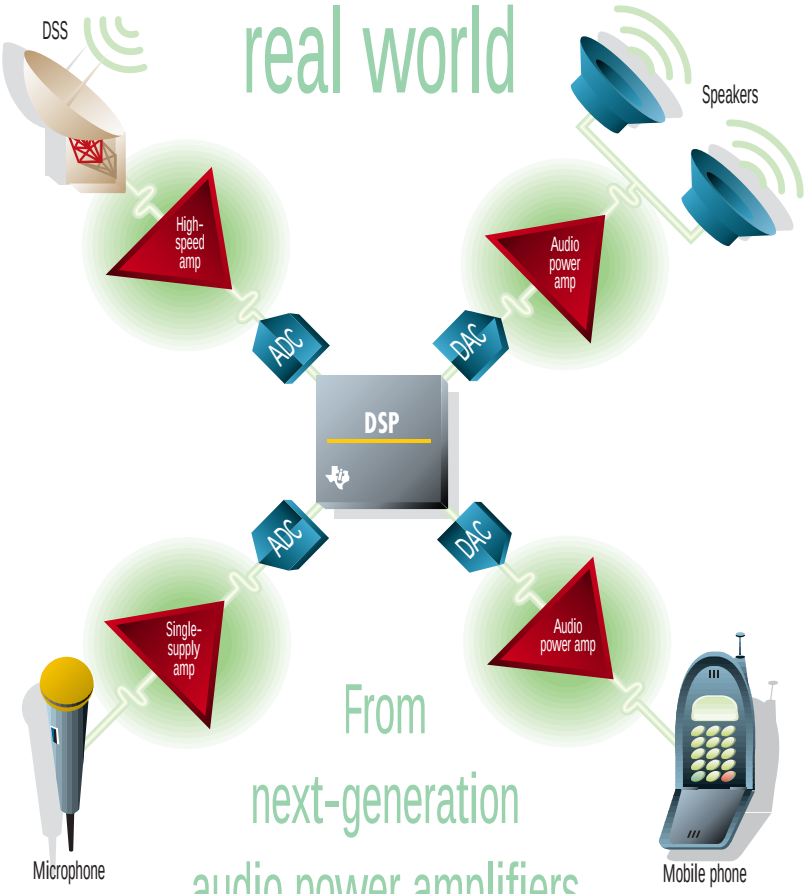


From next-generation audio power amplifiers to single-supply op amps, TI can supply the solution, whatever the design needs.

Continued on the next page.

New audio power amps for note

Next-generation audio power amplifiers from Texas Instruments, including the TPA005D12, the TPA005D14 and the TPA01x2 family, will give designers more options for audio designs.

2-W Class-D audio power amplifiers

The TPA005D12 and TPA005D14 give audio designers three major improvements over current Class-D APAs.

Both devices are configured as bridge-tied load (BTL) amplifiers and are capable of delivering up to 2 W of continuous average power into a 4-Ω load.

First, an integrated stereo headphone drive cuts PC board space by reducing chip count. Second, a lower operating supply current and an improved shutdown control help maximize battery life. Third, reduced total harmonic distortion plus noise (THD+N — 0.2%) improves sound quality.

These new products are optimized for 5-V applications including notebook computers and multimedia speakers.

For any application requiring integrated headphone drive, long battery life and low THD+N, TI's next-generation Class-D APAs are an excellent choice.

Product features

- Integrated headphone drive ('D14)
- Low supply current
- Improved shutdown control
- Low THD+N
- Extensive support tools
- Characterized for operation from –40° C to 85° C
- EVMs available *(See page 25.)*

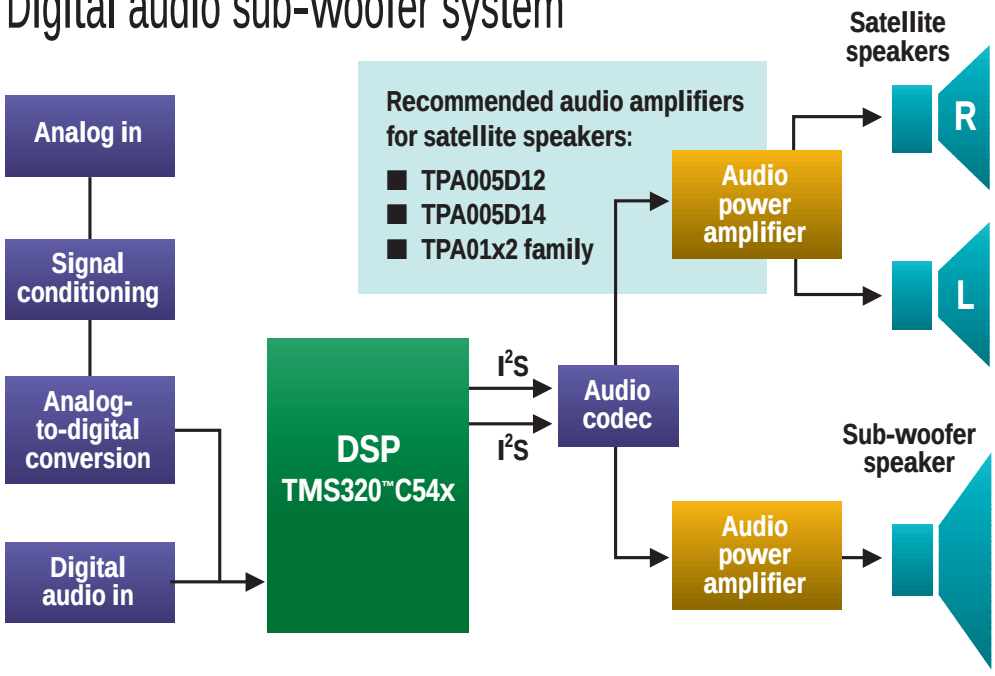
Typical applications

- Notebook computers
- Personal audio
- Point-of-sale (POS) terminals
- Wireless speakers
- Multimedia speakers
- Hands-free car kits

TPA005D1x device comparison

Parameter	TPA005D12	TPA005D14
Supply voltage	4.5 V – 5.5 V	4.5 V – 5.5 V
Output power per channel (peak)	5 W	5 W
Output power per channel (RMS)	2 W	2 W
Supply current (no load or output filter)	25 mA	25 mA
Shutdown current	0.2 µA	0.2 µA
THD+N @1 kHz	0.2%	0.2%
Integrated headphone drive	—	■
Improved shutdown control	■	■
Evaluation modules available	■	■

Digital audio sub-woofer system



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book and multimedia systems

Development tools

Evaluation modules (EVMs) are available for all of TI's APAs, including the TPA01x2 family, the TPA005D12 and TPA005D14.

Each EVM can function as a stand-alone or plug directly into TI's APA Plug 'n Play platform in seconds. Additionally, each EVM kit contains full documentation, including a reference design and bill of materials. To aid in power and thermal calculations, TI offers the Audio Power Analysis Program, a free software package downloadable from TI's website **www.ti.com/sc/techinnovations**

The program computes power and thermal data on all TI APAs, including the TPA01x2 family and the TPA005D12 and TPA005D14 Class-D additions.

2-W linear audio power amplifiers

The TPA01x2 family is the next generation of APAs targeted at notebook computers and battery-powered equipment.

Improvements from the TPA0202 and TPA0102 include internal gain settings, DC volume control and digital volume control. Each enhancement allows designers to save valuable PC board space and simplify board layout.

The fully differential design is another advancement. This feature makes each device compatible with PC 99 specifications by improving power supply rejection ratio (PSRR) and virtually eliminating all "pops" and "clicks" during power-up and power-down cycles. The table at below illustrates which members of the family are compatible with PC 99 desktop and/or portable specifications.

The TPA0112, TPA0132 and TPA0152 consume minimal supply current, thus providing long battery life. The TPA0122, TPA0142 and TPA0162 are designed for applications in which fidelity is more critical than battery life.

Two battery-saving options, shutdown control and a PC-Beep input, are available on all six devices. The shutdown control minimizes supply current when the APA is not in use. The PC-Beep feature allows the system processor to send an alarm tone directly to the APA without bringing the codec out of shutdown mode, which saves valuable battery life that would otherwise be consumed by the codec.

Product features

- Compatible with PC 99 specifications
- DC volume control (TPA0132/42)
- Digital volume control (TPA0152/62)
- Improved depop circuitry
- Shutdown control
- Extensive support tools
- Characterized for operation from –40° C to 85° C
- EVMs available (See page 25.)

Typical applications

- Notebook computers
- Personal audio
- Point-of-sale (POS) terminals
- Wireless speakers
- Multimedia speakers
- Hands-free car kits

TPA01x2 device comparison

Parameter		TPA0112	TPA0122	TPA0132	TPA0142	TPA0152	TPA0162
Supply voltage		4.5 V - 5.5 V	4.5 V - 5.5 V	4.5 V - 5.5 V	4.5 V - 5.5 V	4.5 V - 5.5 V	4.5 V - 5.5 V
Supply current	*SE	3 mA	9 mA	5 mA	10 mA	5 mA	10 mA
	**BTL	6 mA	18 mA	10 mA	20 mA	10 mA	20 mA
Shutdown current		150 µA	150 µA	150 µA	150 µA	150 µA	150 µA
THD+N		0.75%	0.5%	0.4%	0.22%	0.3%	0.22%
PSRR		77 dB	77 dB	67 dB	67 dB	67 dB	67 dB
Volume control		N/A	N/A	DC	DC	Digital	Digital
Minimal external components		■	■	■	■	■	■
Compatible with PC 99 Desktop		■	■	■	■	■	■
Compatible with PC 99 Portable		—	■	■	■	■	■
Improved depop circuitry		■	■	■	■	■	■
Evaluation modules available		■	■	■	■	■	■

* SE = Single-ended mode (used most often to power headphones)
** BTL = Bridge-tied load mode (used most often to power internal speakers)

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Upgrade path from BiFET to BiMOS

Texas Instruments has introduced the first members of its new BiMOS general-purpose operational amplifier families — the TLC07x and TLC08x families.

The BiMOS family concept is simple: provide an upgrade path for BiFET users who are moving away from dual- to single-supply systems and demand higher AC and DC performance.

Both families demonstrate exceptional low-noise and low input bias currents for high impedance, high-performance sensors. The common-mode input voltage range of the TLC08x the negative rail. This capability allows the TLC08x to be used in single-supply systems that require the input to swing near ground.

With service rated from 4.5 V to 16 V across a commercial (0° C to 70° C) and an extended industrial (–40° C to 125° C) temperature range, these BiMOS devices suit a wide range of audio, automotive, industrial, communications and instrumentation applications.

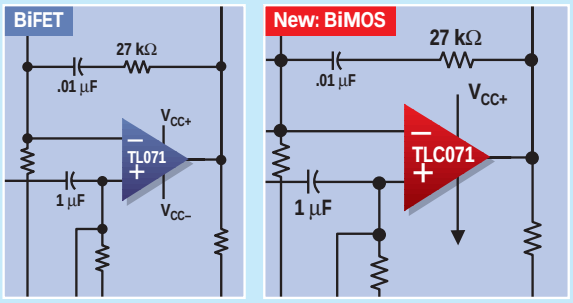
Product features

- Low distortion: THD+N = 0.002% typical
- Low noise
  - TLC07x: 7 nV/√Hz
  - TLC08x: 8.5 nV/√Hz
- Low input bias currents
  - TLC07x: 1.5 pA
  - TLC08x: 3.0 pA
- 10 MHz gain-bandwidth
- 16 V/ms slew rate
- ±55 mA output drive
- 60 µV input offset voltage
- 1.8 mA per-channel supply current
- 125 µA per-channel shutdown supply current

Typical applications

- Audio pre-amplifiers
- Professional 600-Ω audio applications
- Codec interface
- ADC signal conditioning
- Line drivers
- Performance instrumentation
- Communications
- Upgrade to existing standard amplifiers such as TL07x and TL08x

Upgrade to single-supply with the TLC07x



TLC07x/08x family

Device	No. of channels	Shut-down	Package types MSOP	TSSOP	SOIC	PDIP
TLC070/080	1	Yes	8	—	8	8
TLC071/081	1	—	8	—	8	8
TLC072/082	2	—	8 †	—	8	8
TLC073/083	2	Yes	10 †	—	14	14
TLC074/084†	4	—	—	14	14	14
TLC075/085†	4	Yes	—	16	16	16

† This device is in the product preview stage of development. Contact your local TI sales office for availability.

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Amplifiers with very low input bias current

The TLV247x family of BiCMOS process operational amplifiers combines high output drive and low-power consumption with rail-to-rail input/output (RRIO). For applications such as portable equipment and battery-powered data acquisition systems, these devices provide a low-input bias current of just 2.5 pA and a high output drive of +35 mA.

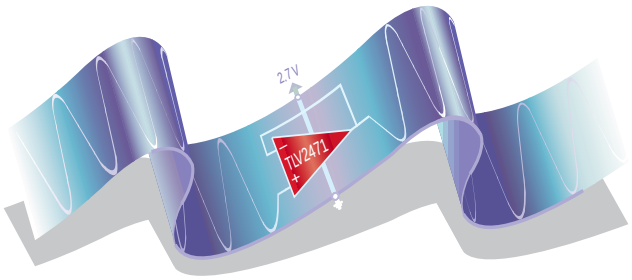
These features overcome shortcomings of previous generations of low-power, rail-to-rail op amps that interface sensors directly to data converters. The low-power TLV247x family is particularly useful in systems with a high-input impedance device, such as a sensor that requires low-input bias currents from an op amp.

These amplifiers lead the industry at a performance node of 2.8 MHz of gain-bandwidth from only 600 µA per channel of supply current. The rail-to-rail devices can swing output to within 30 µV of each supply while comfortably driving +2.5-µA loads. The common mode input voltage range of the TLV247x swings 0.2 V above and below the supply rails. This capability allows its use in single-supply systems where input might swing slightly beyond the rails. TheTLV247x devices are fully characterized at 3 V and 5 V.

The TLV2470, TLV2473 and TLV2475 offer a shutdown mode that places the devices in a high impedance state. While in shutdown state, the power consumption of the devices is reduced to just 350 nA per channel by way of an additional control pin.

The TLV24x0 series of amplifiers is offered as the industry's first RRIO amplifiers featuring shutdown in the small outline transistor (SOT-23-6) package. The TLV2470†, the µ-power TLV2450* and the 6.4-MHz TLV2460 single-channel amplifiers also are offered in this package.

† In the SOT-23-6 package, this device is in the product preview stage of development. Contact your local TI sales office for availability.



TLV247x family at a glance

Device	Channels	Package types	Shutdown
TLV2470	1	SOT-23, SOIC, PDIP	Yes
TLV2471	1	SOT-23, SOIC, PDIP	—
TLV2472	2	SOIC, PDIP, MSOP	—
TLV2473	2	SOIC, PDIP, MSOP	Yes
TLV2474	4	TSSOP, SOIC, PDIP	—
TLV2475	4	TSSOP, SOIC, PDIP	Yes

Product features

- Rail-to-rail input/output
- 2.7-V to 6-V supply voltage
- ±35-mA output drive
- 2.5-pA low input bias current
- 600-µA/channel supply current (@ 3-V supply)

Typical applications

- Sensor interface
- Instrumentation
- Portable or battery-operated equipment
- Data acquisition circuits

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Receivers with extended common-mode voltage range

Six new low-voltage differential signaling (LVDS) data transmission receivers give designers the ability to use the higher speeds and lower power consumption of LVDS in cable-connected and printed circuit board trace applications.

The new LVDS receivers recover data over a common-mode range from –2 V to 4.4 V, which allows up to 3 V of ground noise. This range is three times wider than that available on earlier LVDS devices and provides for maintenance of the data link and reliable transmission over longer distances and in environments with more electrical noise than had been possible in the past. It also extends the performance improvements over RS-422 and RS-485. LVDS features 40 times the speed (400 Mbps) and 10 times lower power consumption than these older transmission schemes.

With the high-speed switching of LVDS signals, the TIA/EIA-644 (LVDS) standard requires the use of a terminating resistor at the receiving end of the cable or transmission media. The SN65LVDT32A, SN65LVDT3486A and SN65LVDT9637A are the first LVDS receivers to offer an integrated termination on the receiving inputs. Called LVDT (low-voltage differential signaling with integrated termination) receivers, these devices provide improved signal quality and lower bit error rates, because the integrated 110-Ω termination is closer to the inputs than is possible with discrete resistors. This feature allows designers to save board space by eliminating the need for a terminating resistor on each input.

These LVDS receivers also are the first in the industry to include a terminated fail-safe feature on their inputs, which automatically holds the output lines at a high logic state when no LVDS input signal is present. In case the signal is ever removed from the device's input, the fail-safe feature prevents the output switching on random noise and provides a known logic state at the output. Once signaling returns, the output resumes tracking the input.

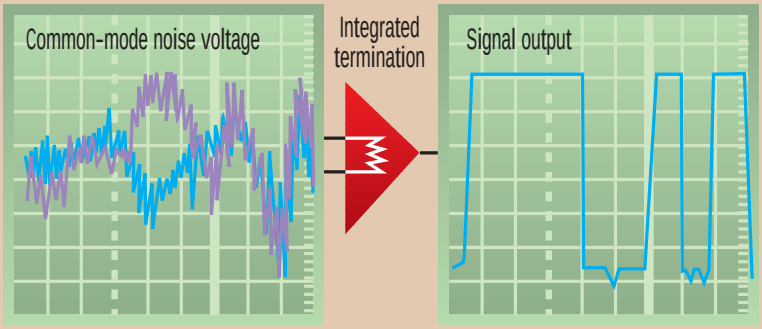
Product features

- –2-V to 4.4-V common-mode voltage range
- Integrated termination
- Terminated fail-safe features
- Tolerate ESD in exceed of 15 kV
- 400-Mbps signaling rate
- Characterized for operation from –40° C to 85° C

Typical applications

- Instrumentation
- Process control
- Point-of-sale (POS) terminals
- Automotive
- Telecommunications
- Video/multimedia systems

SN65LVDT32A common-mode rejection



SN65LVDS at a glance

Device	Description	Package
SN65LVDS32A	Quad receiver; enables all four drivers	16-pin SOIC
SN65LVDS3486A	Quad receiver: enables two of four drivers	16-pin SOIC
SN65LVDS9637A	Dual receiver	8-pin SOIC
SN65LVDT32A	Quad receiver, integrated termination; enables all four drivers	16-pin SOIC
SN65LVDT3486A	Quad receiver, integrated termination; enables two of the four drivers at once	16-pin SOIC
SN65LVDT9637A	Dual receiver, integrated termination	8-pin SOIC

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LVDS line driver, receiver in SOT-25 package

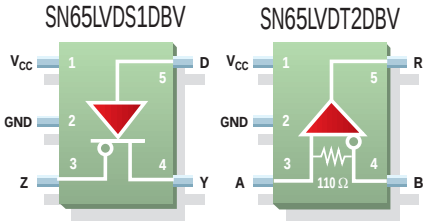
The SN65LVDS1 and SN65LVDT2, single line driver and a single line receiver, respectively, prevent data transmission bottlenecks by delivering signaling rates of up to 400 Mbps.

The devices offer integrated termination, which implements the electrical characteristics of low-voltage differential signaling (LVDS). Texas Instruments is the first supplier to offer these devices with both integrated termination and SOT-25 packages.


Actual size of the SN65LVDS1 and SN65LVDT2

The SN65LVDS1 and SN65LVDT2 feature a wide supply voltage range from 2.4 V to 3.6 V. When used together for point-to-point connection, data or clock signals can be transmitted over printed circuit board traces or cables at very high rates with very low electromagnetic emission and power consumption. These devices provide the highest ESD tolerance in their class.

The high-speed switching of LVDS signals require the use of a line impedance matching resistor at the receiving end of the cable or transmission media. Named LVDT (low-voltage differential signaling with integrated termination), the SN65LVDT2 offers improved signal quality and lower bit error rates because the integrated 100-W termination is closer to the inputs than is possible with discrete resistors. In addition, the integrated termination feature allows designers to save board space by eliminating the need for a terminating resistor on each input.



Product features

- Signaling rates up to 400 Mbps for receiver, 630 Mbps for driver
- Space-saving SOT-25 package
- Receiver with integrated termination
- ESD in excess of 15 kV
- 5-V tolerant LVTTL level for driver
- Open-circuit fail-safe for the receiver
- Conforms to TIA/EIA-644 standard
- Characterized for operation from –40° C to 85° C

Typical applications

- Battery-powered applications
- Graphic processing
- Telecommunications
- Handheld applications
- All general applications

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LDO regulators and supervisory ci

The latest power management solutions from Texas Instruments include three low dropout (LDO) voltage regulators and a supervisory circuit, all of which support DSP applications.

Dual 1-A LDOs

The TPS767D3xx family simplifies DSP power supply design by combining in one package two 1-A linear-voltage regulators and two power-on resets to monitor each regulated voltage.

Integration of the four functions reduces component count and board size, shortens design cycle time and lowers system cost.

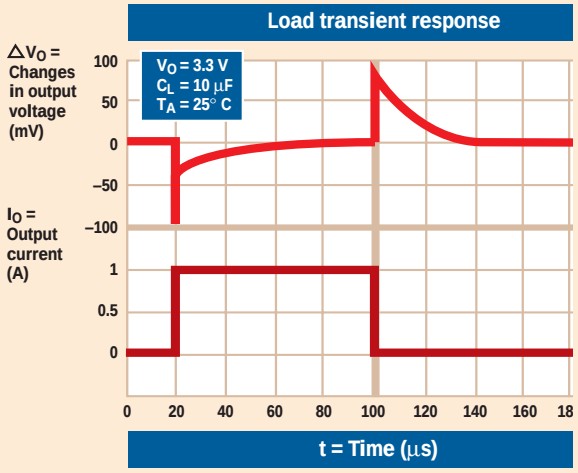
These devices provide very fast transient response, low dropout voltages and low quiescent currents that remain virtually constant (85 µA typical) over the full 1-A output current range of the devices. Dropout voltage is typically 350 mV at 1 A. The combination of micropower operation and low dropout voltages allow the TPS767D3xx LDOs to yield a significant improvement in operating life in battery-powered systems. A logic-enabled shutdown mode further reduces standby current to 1 µA typical.

The TPS767D3xx LDO regulators are designed for applications with rapidly changing load conditions such as DSP-based systems. They feature a transient response time from no load to 1 A of less than 2 µs. The devices work with low-cost 10 µF ceramic capacitors and provide a low-cost complete system solution when fast transient response is needed. Regulator error when stepping from no load to 1 A is less than 2 mV, giving these regulators best-in-class load regulation performance.

TI offers the TPS767D3xx in its unique PowerPAD surface mount package. The thin shrink small outline PowerPAD package increases the thermal efficiency of the part, eliminating the need for bulky heat sinks and consuming considerably less package volume and board space than traditional plastic power packages.

Three versions of the TPS767D3xx are offered, with output voltage options as shown in the table at right.

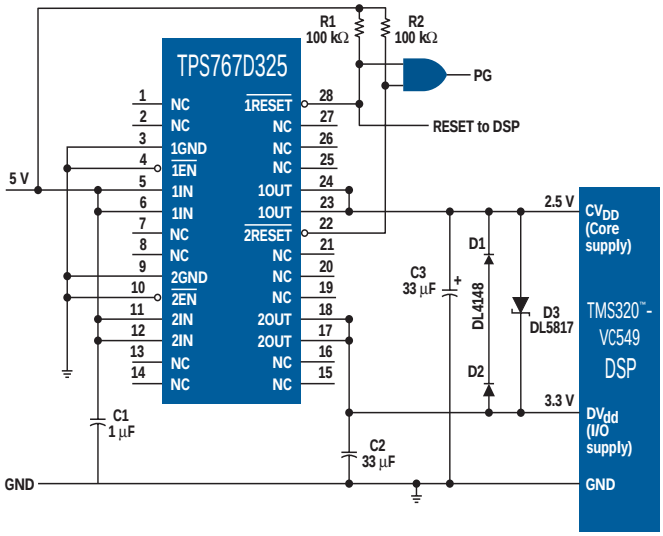
Output current vs. load transient response



Selection guide

Device	Output voltage
TPS767D301PWP	3.3 V and adjustable (1.2 V to 5.5 V)
TPS767D318PWP	3.3 V and 1.8 V
TPS767D325PWP	3.3 V and 2.5 V

Application for the TPS767D3xx



Product features

- Output voltage optimized for low-voltage DSPs
- 1-A outputs for higher loads, can power multiple DSPs
- Dual on-chip power-on resets for design cost reduction and improved system reliability
- Fast transient response using low-cost ceramic capacitors
- 2% tolerance for improved system accuracy
- Ultra-low 85-µA quiescent current and 350-mV dropout voltage for longer battery life
- TSSOP PowerPAD surface mount package

Typical applications

- DSPs with different operating voltages for the I/O section and the processor core
- Mix-mode, low-voltage, battery-powered end equipment

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rcuit support DSP designs

Low-power LDOs with on-chip Power Good output

The TPS765xx and TPS766xx families are intended for a variety of battery-powered applications, including DSP power supplies.

The new LDO families operate with very low quiescent currents, less than 50 µA maximum, while maintaining only 80 mV dropout performance and 3 percent output accuracy. Low quiescent current and low dropout voltage contribute significantly to reducing battery drain and increasing operating life in portable systems. A logic-enabled shutdown mode further reduces standby current to less than 1 µA.

The families feature a Power-Good (PG) output that can be used to monitor the regulator output. If battery drain should cause the regulator output voltage to drop below the specified operating range, the PG output turns on, providing a logic low output signal. PG can be used to drive power-on reset circuitry or as a low-battery indicator. The two families differ only in output current rating. The TPS765xx devices are 150-mA LDOs; the TPS766xx devices are 250-mA regulators.

The TPS765xx and TPS766xx are available in the small outline integrated circuit (SOIC) package.

Product features

- Ultra-low quiescent current for longer battery operating life
- Low dropout voltage for fewer batteries, lower power dissipation
- Output voltages optimized for low-voltage portable designs
- 150-mA and 250-mA versions for design flexibility
- On-chip Power Good output monitors output voltage
- 3% tolerance for improved system accuracy
- Space-saving TSSOP and SOIC surface mount packaging

Typical applications

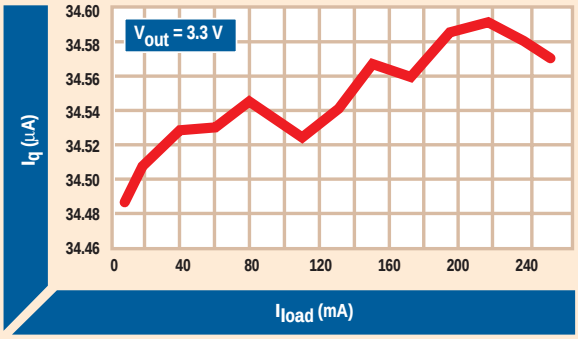
- Low-voltage, battery-powered end equipment
- DSP power supply
- Wireless handsets
- Portable test and measurement equipment
- Portable communications, toys and games

Output voltage for the TPS765xx and TPS766xx

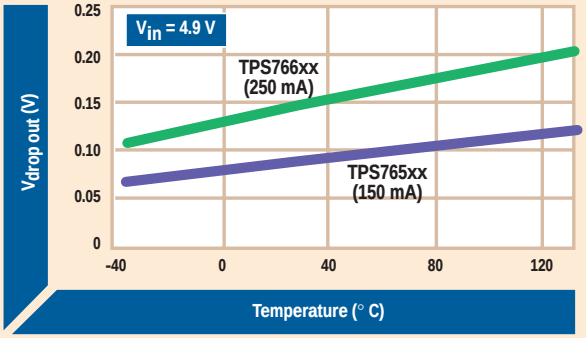
Output voltage options for the TPS765xx and TPS766xx LDOs are shown in the table below. Voltage selection range for the adjustable regulators is 1.5 V to 5.0 V. In the table, "xx" in the device names represents the output voltage option. For example, the device name for the 3.3-V option is TPS76533 or TPS76633. The adjustable output options are TPS76501 and TPS76601.

Device	Output current	Output voltage options (V)
TPS765xx	150 mA	1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.3, 5.0, adjustable
TPS766xx	250 mA	1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.3, 5.0, adjustable

TPS766xx quiescent current vs. load current



Dropout voltage vs. junction temperature



LDO selection guide for TI DSPs

DSP family	Single regulator	Dual regulator
TMS320™C2000 platform		
■ 5-V DSP	TPS76550 or TPS76650	N/A
■ 3.3-V DSP	TPS76533 or TPS76633	N/A
TMS320C3x platform		
■ 5-V DSP	TPS76550 or TPS76650	N/A
■ 3.3-V DSP	TPS76533 or TPS76633	N/A
TMS320C5000 platform		
■ 5-V DSP	TPS76550	N/A
■ 3.3-V DSP	TPS76533	N/A
■ Mixed-mode 3.3-V and 2.5-V DSP	TPS76533 and TPS76525	TPS767D325
■ Mixed-mode 3.3-V and 1.8-V DSP	TPS76533 and TPS76518	TPS767D318
TMS320C6000 platform		
■ Mixed-mode 3.3-V and 1.8-V DSP	TPS76633 (core only)	TPS767D318

Power management continued on next page

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New supervisory circuit with integrated delay-time

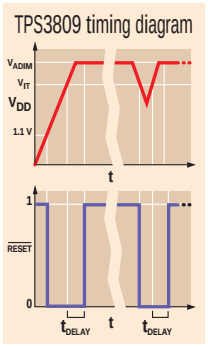
The new TPS3809 supervisory circuit supports DSP and microprocessor applications by saving board space and system costs without requiring any external components. Available in a small 3-pin SOT-23 package and requiring no external components, the TPS3809 saves board space and system costs.

To achieve a reliable electronic system and a proper start after power-on or after a serious voltage drop, the digital system must be forced into a defined initial state. To implement these functions while preventing problems, the TPS3809 features accurate detection of a voltage drop below the critical supply voltage and generates a RESET signal whenever the supply voltage is not in the allowed range.

The device also keeps the reset signal active for a defined time of t_d = 200 ms. For this purpose, DSPs and microprocessors already have a RESET input, as shown in the application below.

During power-on, RESET is asserted when the supply voltage V_{DD} becomes higher than 1.1 V *(See timing diagram)*. Thereafter, the supervisory circuit monitors V_{DD} and provides RESET active as long as V_{DD} remains below the threshold voltage, V_{IT}. An initial timer delays the return of the output to the inactive state (Logic "high") to ensure proper system reset. The delay-time td starts after V_{DD} has risen above VIT.

When the supply voltage drops during normal operation below V_{IT}, the output of the TPS3809 becomes active (Logic "low") again. A preprogrammed internal resistor divider for the different threshold voltages V_{IT} allows glueless interface to DSPs and microprocessors.



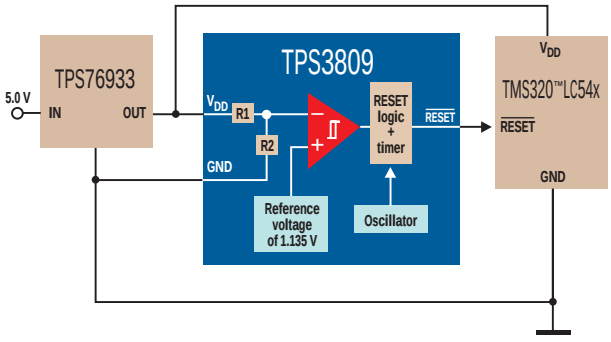
Product features

- 3-pin SOT-23 package
- Supply current of 9 mA (typical)
- Precision supply voltage monitor of 2.5 V, 3.0 V, 3.3 V and 5.0 V
- Power-on reset generator with fixed delay-time of 200 ms
- Characterized for operation from –40° C to 85° C

Typical applications

- Microprocessor and DSP applications (especially battery-driven systems)

TPS3809 typical application with a DSP



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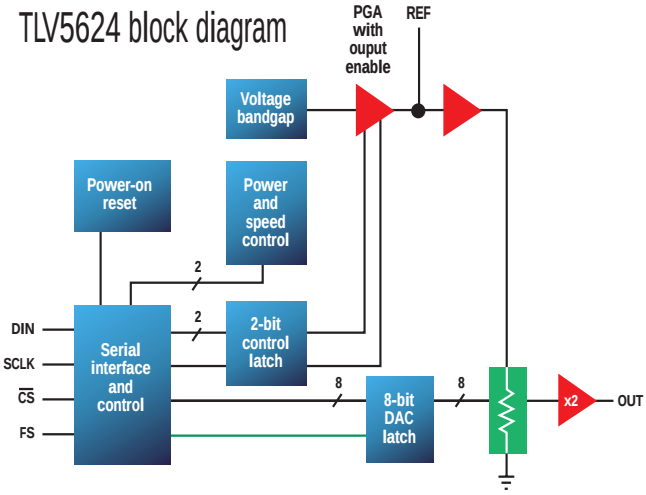
Industry's leading 8-bit voltage output DACs

Five new digital-to-analog converters (DACs) from Texas Instruments offer a high performance-to-price ratio and are available in small packages. The TLV5623, TLV5624, TLV5625, TLV5626 and TLV5627 are 2.7-V to 5.5-V, low-power, 8-bit DACs with power-down capability.

As the industry's leading voltage output DACs, these devices operate with very low power consumption, 3 mW typical. They are well suited for a wide range of applications.

The programmable settling time offers customers the flexibility of either fast settling time or low power. All of these DACs interface glueless-ly to TI's TMS320 DSPs as well as (Q)SPI and Microwire serial interfaces.

TLV5624 block diagram



The TLV562x family at a glance

Device	Packaging	No. of bits	No. of channels	Reference
TLV5623	8-pin SOIC and 8-pin MSOP	8	1	External
TLV5624	8-pin SOIC and 8-pin MSOP	8	1	Internal
TLV5625	8-pin SOIC	8	2	External
TLV5626	8-pin SOP	8	2	Internal
TLV5627	16-pin SOP and 16-pin TSSOP	8	4	External

Product features

- One, two and four 8-bit DACs
- Serial interface
- Internal reference (TLV5624, TLV5626)
- External reference (TLV5623, TLV5625, TLV5627)
- Programmable settling time vs. power
- Low power consumption
- Compatible with TMS320 and (Q)SPI and Microwire serial ports
- Power-down mode

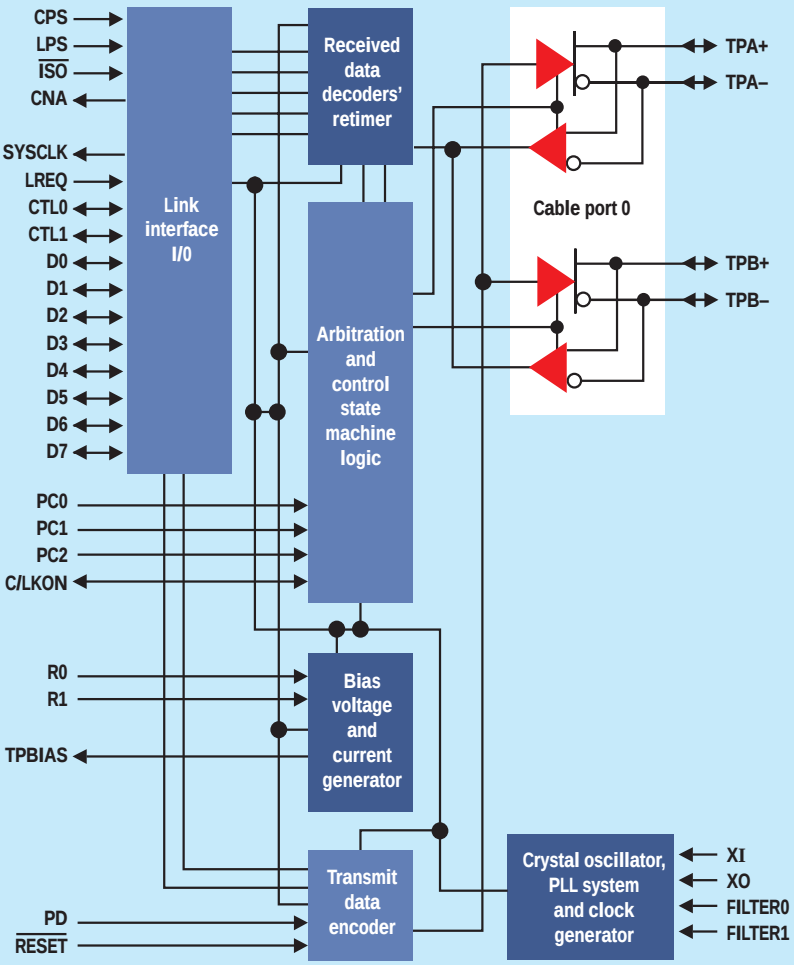
Typical applications

- Digital servo control loops
- Digital offset and gain adjustment
- Industrial process control
- Machine and motion control devices
- Mass storage devices

DATA SHEETS APP REPORT PRICING SUGGESTED RESALE PRICE STARTING AT $1.14@1K qty.

New low-power IEEE 1394 PHY for portables

TSB41LV01 block diagram



400-Mbps PHY family

Device	Packaging	No. of ports	Availability
TSB41LV01	64-pin TQFP	1	Available now
TSB41LV02	64-pin TQFP	2	Available now
TSB41LV03A	80-pin TQFP	3	Available now
TSB41LV04A	80-pin TQFP	4	Available now
TSB41LV06A	100-pin TQFP	6	Available now

The TSB41LV01, a one-port, 400-Mbps IEEE 1394 physical layer (PHY) device from Texas Instruments, offers an ultra-low power mode that enables significant system power reduction for portable systems.

The TSB41LV01 provides the digital and analog transceiver functions needed to implement a two-port node in a cable-based IEEE 1394 network. The cable port incorporates two differential line transceivers. The transceivers include circuitry to monitor the line conditions as needed for determining connection status, for initialization and arbitration, and for packet reception and transmission.

In ultra-low power mode, the TSB41LV01 typically consumes just 150 µA of power, a significant improvement over comparable devices that consume approximately 45 mA.

That performance makes the device up to 300 percent more efficient than competitive 1394 devices.

The TSB41LV01 also provides designers with other low-power consumption features such as automatic device power-down during suspend, a link interface disable and the capability to automatically power down an inactive port.

The device is the latest in TI's ultra-low power, 400-Mbps PHY family that includes the TSB41LV02, TSB41LV03A, TSB41LV04A and TSB41LV06A. All of these devices are the first to implement the IEEE 1394a 2.1 specification and are fully compatible with TI's link layer family, including the OHCI-Lynx, peripheral and consumer electronics link layer controllers.

The TSB41LV01 is available in a 64-pin PAP thermally enhanced PowerPAD™ package.

Product features

- **Fully interoperable with FireWire™ and i.LINK implementation of IEEE 1394 Standard**
- **Provides two 1394a fully compliant cable ports at 100/200/400 Mbps**
- **Fully compliant with OpenHCI requirements**
- **Fully compliant with IEEE 1394a including arbitrated short reset, arbitration acceleration, fly-by concatenation and port disable/suspend/resume**
- **Ultra low-power sleep mode**
- **Meets Intel Mobile Power Guideline 2000**

Typical applications

- **PC cameras**
- **Motherboards**
- **Add-in boards**
- **Storage devices**
- **Mobile applications**

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High-end audio codec for low-power applications

With the new TLC320AD77, a high-end, 100-dB audio codec from Texas Instruments, audio system designers can experience immediate performance improvements over conventional solutions. The 'AD77 works well with the TAS3001 digital EQ processor, providing a combination that offers the highest audio fidelity over any analog solution.

This new digital speaker technology is a cost-competitive stereo analog-to-digital converter (ADC) and digital-to-analog converter (DAC) for consumer applications that demand superior audio performance. It offers a wide variety of serial input options.

The 'AD77 has an extremely wide range of sampling rates from 16 kHz to 96 kHz, which works well with many system applications, including mini disks, digital video disk (DVD), audio/video (A/V) receivers, musical instruments and digital television. It also has a recording capability of 96 kHz, which will allow the duplication of previously recorded 48-kHz material in half the time.

A high power supply rejection ratio (PSRR) reduces component count because of a high tolerance to power supply variations. The 'AD77 provides a differential input in the ADC for higher performance, but a single input can be used for lower performance and a simpler system. A DB small shrink outline package (SSOP) reduces board space.

This 100-dB audio codec works well in a variety of end equipments requiring high-performance digital/audio conversion. The 'AD77 will help move applications to the next performance level without adding cost.

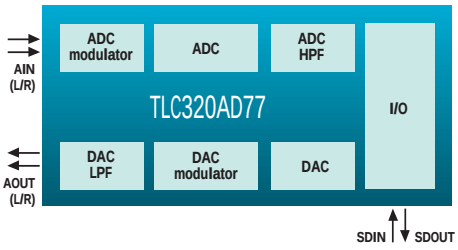
Product features

- High-performance 100-dB SNR
- Dynamic range a full 100 dB
- Data formats of 16/20/24 bit
- Wide selection of sampling rates (16-96 kHz)
- 8 serial interface formats
- De-emphasis filter (32, 44.1, 48 kHz)
- Internal bandgap voltage reference
- High jitter tolerance

Typical applications

- Mini disks
- Digital video disk (DVD)
- Audio/video (A/V) receivers
- Musical instruments
- Digital television

TLC320AD77 block diagram



DATA SHEETS APP REPORT PRICING SUGGESTED RESALE PRICE $2.81@1K qty.

Multi-gigabit transceiver supports 1.6 to 2.5 Gbps

The new TLK2500 multi-gigabit transceiver from Texas Instruments provides ultra high-speed input/output (I/O) data channels for point-to-point baseband data transmission over a variety of media types.

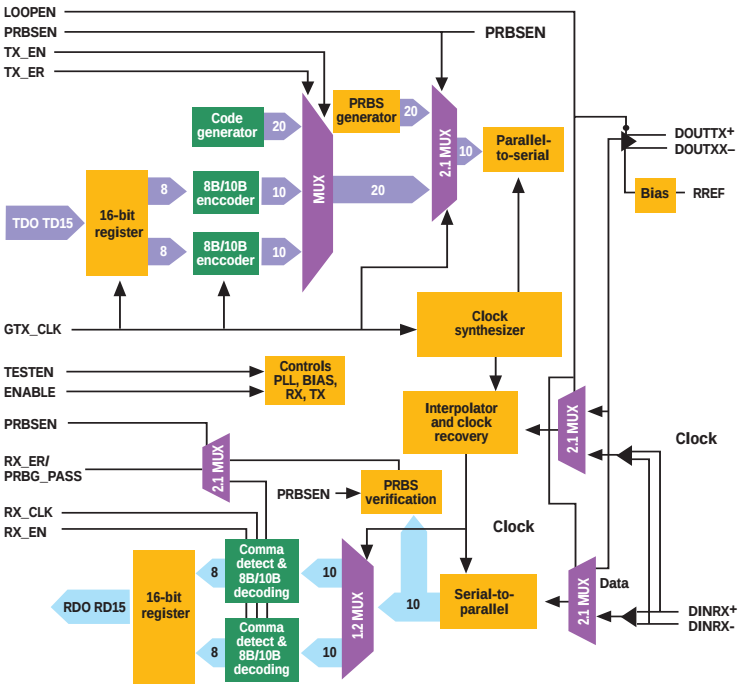
The TLK2500 supports a serial interface speed of 1.6 Gbps to 2.5 Gbps, providing up to 2.0 Gbps of actual data bandwidth in each direction. The transceiver also can be used to replace parallel data transmission architectures by providing a reduction in the number of traces, connector pins and transmit/receive pins.

Parallel data loaded into the transmitter is delivered to the receiver over a serial channel, which can be a coaxial copper cable, a controlled impedance backplane or an optical link.

The data is then reconstructed into its original parallel format. The TLK2500 offers significant power and cost savings over current solutions, as well as scalability for higher data rate in the future.

The parallel interface supports the GMII (Gigabit Media Independent Interface) defined in IEEE P802.3z with extensions for data rates up to 2 Gbps. The interface provides a simple, inexpensive and easy way to implement interconnection between the media access control (MAC) sublayer and physical layer (PHY). The IEEE P802.3z GMII interface provides independent 8-bit wide transmit and receive data paths for full-duplex operation. The TLK2500 extends the standard GMII transmit and receive data paths to 16 bits, thus allowing for 2-Gbps operation at the same parallel-side clock speed.

TLK2500 block diagram



Product features

- Integrated serializer/deserializer (SERDES), clock synthesis and clock recovery
- Parallel I/O 16-bit wide, 3.3-V TTL and GMII (per 802.3z) compatible with 2
- Serial I/O: differential CML (high-speed Current Mode Logic) driver with adjustable swing
- On-chip 8B/10B encode/decode
- Differential CML serial I/O
- Hot-plug capable I/O
- Built-in PRBS generation
- Low power <325 mW at 2.5 Gbps, 2.5-V supply, 64-pin VQFP

Typical applications

- Point-to-point data link
- Serial backplane
- Switched channel fabric
- Crosspoint ports
- ECL/PECL link replacement
- Examples: hubs/routers, switches, digital cross-connects, SONET equipment backplanes, servers

DATA SHEETS APP REPORT PRICING SUGGESTED RESALE PRICE $32.00@10K qty.

Low-power, high-performance 16-bit OTP microcontrollers

The MSP430P325A and the MSP430P337A, the newest members in the MSP430 microcontroller family from Texas Instruments, offer an unmatched ratio between ultra-low power consumption and a high-performance, 16-bit microcontroller core in a one-time-programmable (OTP) version.

The new devices reduce current consumption by more than 80 percent, compared to existing MSP430 OTP devices, and are now comparable with the ROM versions. The 16-bit RISC core is built in an orthogonal structure and uses only 27 core instructions, which makes it easy to use.

The MSP430P325A features include a high-resolution, 14-bit analog-to-digital converter (ADC) and an integrated LCD driver for up to 84 segments, making the device a complete measurement system on a single chip. The device is ideally suited for portable measurement equipment in which the ultra-low power consumption combined with the 14-bit ADC and LCD driver help to save system cost.

The MSP430P337A offers device features such as an integrated hardware multiplier, universal synchronous/asynchronous receiver/transmitter (USART) and a LCD driver for up to 120 segments. The device supports higher-end applications in which more arithmetic-intensive calculations can benefit from the integrated hardware multiplier with the USART for ease of communication off-chip.

Overview of MSP430 configurations with the ultra-low power OTP cell

Device	OTP	RAM	ADC	LCD	Package	Available
MSP430P315	16 kB	512 B	Slope	92 seg	SSOP	Now
MSP430P325A	16 kB	512 B	14 bit	84 seg	QFP/PLCC	Now NEW
MSP430P337A	32 kB	1 kB	Slope	120 seg	QFP	4Q99
MSP430P112	4 kB	256 B	Slope	None	SOP	Now

Development tools

The development tools for the MSP430x32x include an evaluation kit from TI and in-circuit emulators and a C-compiler from third-party development tool partners. A free download page for the MSP430 Simulation Environment and information about the MSP430 third-party tool vendors are available at **www.ti.com/sc/techinnovations**

Also, see the listing for mixed-signal controllers development tools on page 25.

Availability

The ultra-low power OTP versions MSP430P325AIPG/IPM/IFN and the MSP430P337AIPJM are available now. The low-power OTP version MSP430P315IDL and MSP430P112IDW have been available since last year.

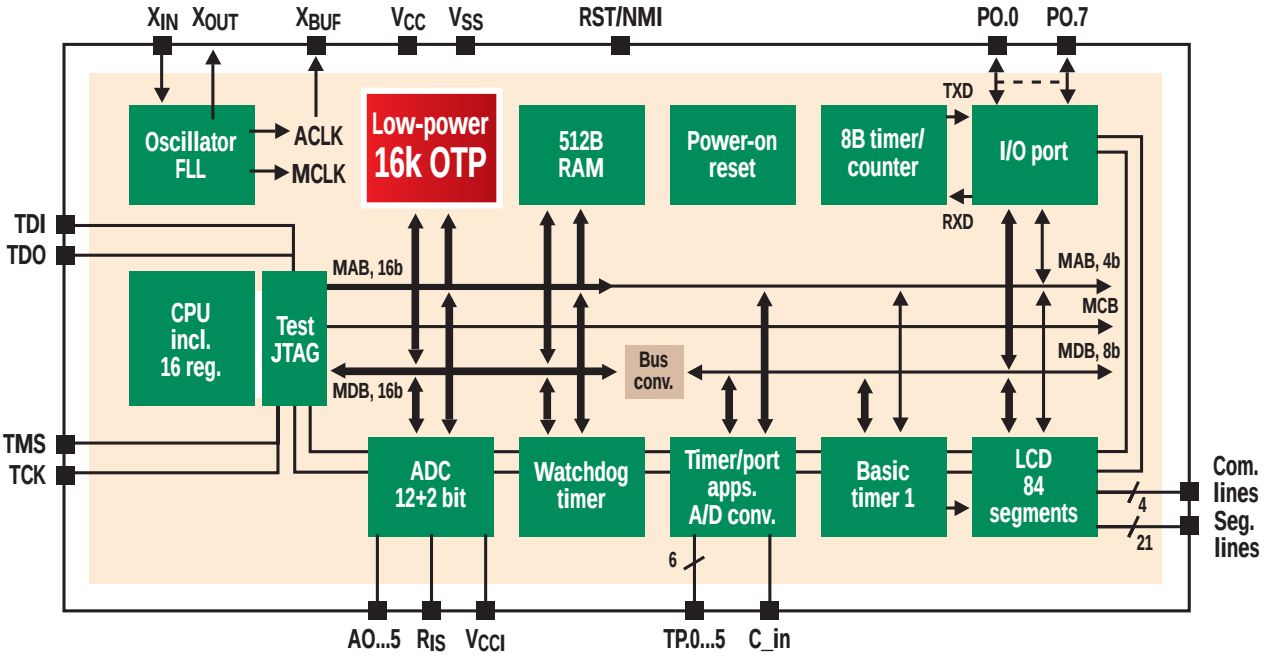
Product features

- Ultra-low power OTP cell included
- Ultra-low power consumption: 500 µA active, 1.3 µA in standby, 0.1 µA in RAM retention/off mode
- 16-bit orthogonal RISC architecture with high throughput and up to 3.3 MIPS
- Fast wake-up from sleep mode (max. 6 µs)
- 7 different addressing modes for 51 (27 core) instructions

Typical applications

- Portable instrumentation
- Medical equipment
- Sports applications
- Environmental measurement
- Utility metering
- Home automation

MSP430 block diagram



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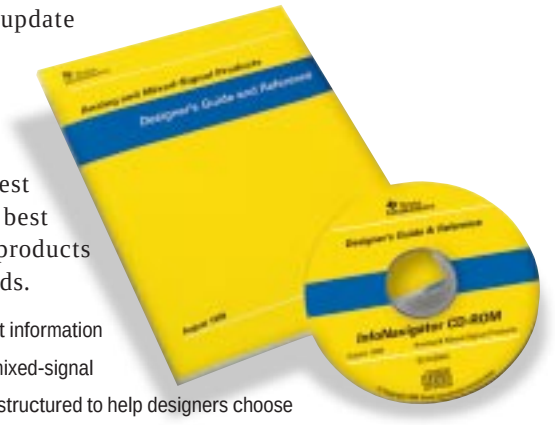
FREE Design guides

Get the latest design solutions from TI's 'Analog and Mixed-Signal Designer's Guide' and CD-ROM

The August 1999 update of the *Analog and Mixed-Signal Designer's Guide* and CD-ROM offers designers the quickest way to identify the best Texas Instruments products for their design needs.



Documenting the latest information on TI's many analog and mixed-signal products, each section is structured to help designers choose products based on system requirements. The guide also features previews of new devices, decision trees, selection guides, parametric tables for each listed product, an ordering guide and a new section listing compatible data converter and power management products for TI DSPs.

Updated Aug. '99

The InfoNavigator CD-ROM is an interactive electronic guide containing more than 20,000 pages of datasheets, application notes and a "no-installation," web-based version that uses a system's web browser to read directly from the CD, thus making installation on a hard disk drive unnecessary.

This device can operate in a stand-alone (off-line) mode, in which the CD-ROM acts as a self-contained website, making more than 90 percent of the analog and mixed-signal product information available on TI's website accessible via the CD. Its main benefit is its use with an online connection. The many live links can take viewers directly to the TI web site while the CD-ROM continues running in the background. The InfoNavigator CD-ROM also offers a web-based refresh capability for information and parts released after the CD-ROM's manufacture date.

New 'Analog Applications' book provides practical tips for fast design solutions

Designers can get products to market quickly with the help of *Analog Applications*, a book of application notes from Texas Instruments.

This collection offers a basic understanding of TI's products and provides simple but practical examples for typical applications. Specific notes also show how TI devices can be used to solve specific design requirements. For example, the book covers solutions for design challenges in precision analog, data acquisition, power management and data transmission. Specific notes also show how TI devices can be used to solve specific design requirements.

The book also includes tutorial information, practical engineering solutions and helpful hints. Where applicable, software routines and program structures are covered as well. *Analog Applications* is written for design engineers, engineering managers, technicians, system designers and marketing and sales people. Along with analog design tips, the large number of DSP applications makes these notes a valuable resource for signal processing engineers.

The book, which will be updated regularly, exemplifies TI's commitment to remaining the world leader in analog and mixed-signal by providing the products and resources that help the electronic design community develop the best products.

Evaluation modules

Each EVM kit **contains a fully assembled evaluation board, datasheet and a user's guide for the evaluation board. Some kits also include application notes, plus necessary software, cables and connectors. To order any of the EVM kits listed, please call our toll-free order desk number 1-800-477-8924, ext. 5800 in North America. To order in Europe, Asia and other regions, contact the TI Product Information Center for your region (see back page) or contact your local TI distributor; see www.ti.com/sc/docs/distmenu.htm for distributor listings. Prices are subject to change. Check www.ti.com/sc/techinnovations and search for the EVM you want for the most-up-to-date information.**

Audio Power Amplifiers

TPABASEKITEVM[1]	Plug 'n Play base kit	$225
MIC/MIXEREVM	Signal conditioning/mixing with TLC2274	$50
DC/DC-Converter	Switch-mode power supply with TL5001	$50
TPA005D02EVM	2-W stereo BTL Class-D	$100
TPA005D12EVM	2-W Class-D stereo APA	$100
TPA005D14EVM	2-W Class-D stereo APA with headphone drive	$100
TPA0102EVM	1.5-W stereo SE/BTL APA	$50
TPA0103EVM	1.75-W stereo/mono SE/BTL	$50
TPA0112EVM	2-W stereo SE/BTL APA, 2-bit volume control	$50
TPA0122EVM	2-W stereo SE/BTL APA, 2-bit volume control	$50
TPA0132EVM	2-W stereo SE/BTL APA, DC volume control	$50
TPA0142EVM	2-W stereo SE/BTL APA, DC volume control	$50
TPA0152EVM	2-W stereo SE/BTL APA, up/down volume control	$50
TPA0162EVM	2-W stereo SE/BTL APA, up/down volume control	$50
TPA0202EVM	2-W stereo BTL and SE with Depop APA	$50
TPA1517NEEVM	6-W stereo SE APA	$50
TPA1517DWPEVM	6-W stereo SE APA	$50
TPA102MSOPEVM	150-mW stereo SE APA	$50
TPA112MSOPEVM	150-mW stereo SE APA	$50
TPA122MSOPEVM	150-mW stereo SE APA	$50
TPA152EVM	75-mW hi-fi stereo SE with Depop APA	$50
TPA302EVM	300-mW stereo SE APA	$50
TPA301EVM	350-mW mono BTL APA	$50
TPA311EVM	350-mW mono BTL/SE with Depop APA	$50
TPA311MSOPEVM	350-mW mono BTL/SE with Depop APA	$50
TPA701MSOPEVM	700-mW mono BTL APA	$50
TPA711MSOPEVM	700-mW mono BTL/SE with Depop APA	$50
TPA721MSOPEVM	700-mW mono BTL/SE with Depop APA	$50
TPA4860EVM	1-W mono BTL with headphone sense APA	$50
TPA4861EVM	1-W mono BTL APA	$50

High-Speed Amplifiers

THS3001EVM	420-MHz, 6500-V/µs	$50
THS4001EVM	300-MHz, 400-V/µs	$50
THS4011EVM	290-MHz, 310-V/µs	$50
THS4012EVM	290-MHz, 310-V/µs	$50
THS4031EVM	100-MHz, 100-V/µs, low noise	$50
THS4032EVM	100-MHz, 100-V/µs, low noise	$50
THS4051EVM	70-MHz, 240-V/µs	$50
THS4052EVM	70-MHz, 240-V/µs	$50
THS4061EVM	180-MHz, 400-V/µs	$50
THS4062EVM	180-MHz, 400-V/µs	$50
THS6002EVM	ADSL transceiver	$75
THS6012EVM	ADSL driver	$75
THS6022EVM	ADSL driver	$75
THS6062EVM	ADSL receiver	$75
THS7002EVM	70-MHz, PGA	$75

Single-Supply Amplifiers

SLOP120	Universal Op Amp EVM	Free[2]
UNIV-OPAMP-1B	Universal Op Amp EVM (20 pcs.)	$50
SLOP224	Universal Op Amp with Shutdown EVM	Free[2]
UNIV-OPAMP-2B	Universal Op Amp with Shutdown EVM (20 pieces)	$65

Mixed-Signal Controllers

MSP-STK430X320	MSP430 Starter Kit	$99
MSP-EVK430X110	MSP430x11x Evaluation Kit	$399
MSP-EVK430X320	MSP430x32x Evaluation Kit	$399
MSP-EVK430X330	MSP430x33x Evaluation Kit	$399
MSP-PRG430	MSP430 Programming Adapter	$171
MSP-SIM430	MSP430 Simulation Environment	$177
MSP-FPP43	MSP430 Floating Point Package	$177

Bus Solutions

TSBKPCI403[3]	PCILynx2™ and 400-Mbps PHY value board	$275
TSBKOHCI403[3]	OHCI Lynx™ and 400-Mbps PHY value board	$275

Data Converters

TLC876EVM	10-bit, 20-MSPS ADC	$160
TLC5510EVM	8-bit, 20-MSPS ADC	$125
TLV5510EVM	8-bit, 10-MSPS ADC	$125
TLC5540EVM	8-bit, 40-MSPS ADC	$125
TLV5580EVM[2]	8-bit, 80-MSPS ADC	$170
TLC2543EVM	5-V, 12-bit ADC	$75
TLV2543EVM	3-V, 12-bit ADC	$75
TLV1544EVM	10-bit ADC with serial control and 4/8 analog inputs	$125
TLV1572EVM	10-bit, 1.25-MSPS, 2.7-5.5 V serial ADC with power-down	$125
TLV1570EVM	10-bit, 1.25-MSPS, 2.7-5.5 V serial ADC with power-down	$125
TLV2544EVM	12-bit, 200-KSPS ADC	$180
TLV2548EVM	12-bit, 200-KSPS ADC	$180
TLC320AD50EVM[3]	16-bit sigma delta AIC	$75
TLC2932EVM[3]	50-MHz Phase Lock Loop	$85

Data Transmission

SN65LVDS31/32	LVDS Evaluation Kit	$35
TIR2000EVM[3]	High-speed IrDA controller	$99

Power Management

TPS60100EVM-131	Charge pump, 1.8-V to 3.6-V to 3.3-V/200-mA	$39
TPS60110EVM-132	Charge pump, 2.7-V to 5.4-V to 5-V/300-mA	$39
TPS9104EVM	Cellular phone P/S with audio PAs	$50
TPS6735EVM	5-V, 200-mA inverting DC-DC converter	$50
TL5001EVM-087	5-V to 3.3-V, 3-A buck converter	$75
TL5001EVM-089	9-V to 3.3-V, 3-A synchronous buck converter	$85
TL5001EVM-097	9-V to 5/3.3-V, 2.6-A buck converter	$45
TL5001EVM-101	5-V to 3.3 -V, 3-A buck converter	$50
TL5001EVM-102	5-V to 2.5-V, 3-A buck converter	$50
TL5001EVM-103	5-V to 1.8-V, 3-A buck converter	$50
TL5001AEVM-108	5-V to 3.3-V, 3-A, 3% buck converter	$75
TL5001AEVM-109	5-V to 2.5-V, 3-A, 3% buck converter	$75
TL5001AEVM-110	5-V to 1.8-V, 3-A, 3% buck converter	$75
TPS5210EVM-116	12-V to 1.3-V - 3.5-V, 19-A PWM buck converter	$150
TPS5210EVM-119	12-V to 1.3-V - 3.5 V, 19-A PWM buck converter	$175
TPS5602EVM-121	Dual output (3.3-V and 1.8-V) synchronous buck converter	$85
TPS56100EVM-128	5-V to programmable Vo, 6-A synchronous buck converter	$60
TPS5615EVM-114	5-V to 1.5-V, 6-A, 1% surface-mount synchronous buck converter	$60
TPS5615EVM-115	5-V to 1.5-V, 8-A synchronous buck converter	$60
TPS5618EVM-106	5-V to 1.8-V, 8-A synchronous buck converter	$60
TPS5618EVM-113	5-V to 1.8-V, 6-A, 1% surface-mount synchronous buck converter	$60
TPS5625EVM-105	5-V to 2.5-V, 8-A synchronous buck converter	$60
TPS5625EVM-112	5-V to 2.5-V, 6-A, 1% surface-mount synchronous buck converter	$60
TPS5633EVM-104	5-V to 3.3-V, 8-A synchronous buck converter	$60
TPS5633EVM-111	5-V to 3.3-V, 6-A, 1% surface-mount synchronous buck converter	$60

Video Products

TVP56000EVM[3]	Evaluation Kit for TVP5020 video decoder and TVP6000 video encoder	$1,000

DSP

TMS320C54x	C54x DSK plus an 'AD50 EVM	$224
TMS320C5x	C5x DSK for use with 'AD55/56	$99

[1] The TPABASEKITEVM includes the MIC/MIXER module, the DC/DC converter and all connecting cables.

[2] One free EVM per person or address.

[3] Not available in Europe; no application for CE approval.

Networking

ADSL designs

Samsung and Hyundai

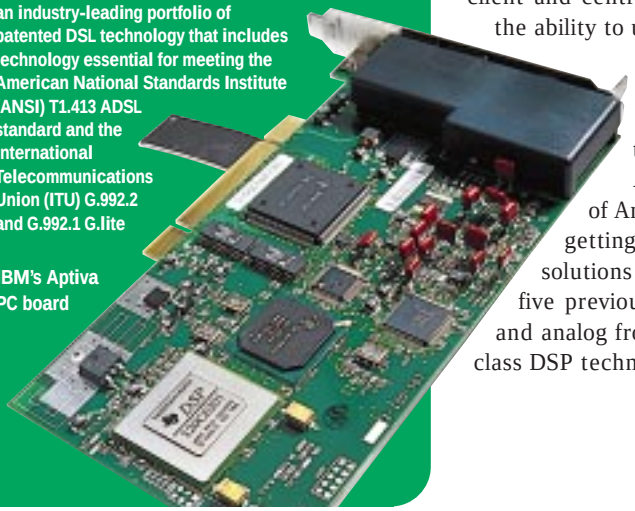
■ Samsung Electronics and Hyundai recently chose TI's TMS320™C6000 DSP-based ADSL technology as the foundation for their next-generation ADSL systems. Both companies will use TI's TNETD3000 remote terminal and central office chipsets in their central office digital subscriber line access multiplexers (DSLAMs) and ADSL remote access equipment.

Legend

■ Legend Group, the largest personal computer (PC) manufacturer in China, recently announced that it will develop an ADSL modem based on the TNETD3000 architecture. At the same time, TI and Legend announced the signing of a Memorandum of Understanding (MOU) to establish the company's first DSP laboratory in Beijing. The Legend ADSL modem will be installed on a client-side computer and can support both International Telecommunications Union (ITU) G.992.1 (8 Mbps/800 Kbps) and ITU G.992.2 (1.5 Mbps/512 Kbps) standards. With the opening of the TI-Legend DSP lab, Legend will also jointly develop other DSP-based applications with TI.

IBM

■ IBM recently announced that it is including TI's ADSL modem technology in its award-winning line of Aptiva desktop PCs to give its customers built-in, high-speed Internet access. This will allow consumers to experience Internet connection speeds of 25 to 100 times faster than today's V.90 or 56K analog modems. TI's ADSL technology will give the Aptiva modems a competitive advantage through an industry-leading portfolio of patented DSL technology that includes technology essential for meeting the American National Standards Institute (ANSI) T1.413 ADSL standard and the International Telecommunications Union (ITU) G.992.2 and G.992.1 G.lite



IBM's Aptiva PC board

TI's ADSL technology delivers a new era of remote access capabilities

With more than 100 times the performance of today's fastest analog modem technology, asymmetric digital subscriber line (ADSL) technology is revolutionizing the remote access industry. ADSL is the broadband communications technology that allows telephone companies to deliver multi-megabit communications performance directly to the home. More importantly, ADSL delivers this high-speed performance over existing copper telephone lines — all while allowing traditional voice services to coexist without interruption.

TI provides high-performance ADSL solutions for both central office and remote terminal applications.

Based on TI's industry-leading, 2400-MIPS, TMS320™C6000 DSP technology, TI ADSL solutions deliver unprecedented levels of performance and programmability.

TI's multi-line architecture offers major advantages for central office applications, allowing designers to implement up to four fully independent ADSL modems with a single chipset. For PC client applications, TI's high levels of integration deliver a lower total system cost and simplify design. The industry's highest port densities also enable major advantages for central office ADSL designers. Industry-leading programmability and interoperability for both PC client and central office applications give designers the ability to upgrade to any version of ADSL with a simple software upgrade. This, in turn, enables OEMs to dynamically react to market demands in a real-time, customer-focused way.

TI's multi-line architecture offers major advantages for central office applications, allowing designers to implement up to four fully independent ADSL modems with a single chipset.

All of TI's ADSL chipsets benefit from the company's acquisition of Amati Communications. As a result, designers can be sure they are getting the most advanced, cost-effective and high-performance ADSL solutions available — a product of Amati's extensive field trial experience, five previous generations of proven DSL chipsets, DSL software expertise and analog front end (AFE) designs. TI combines this leadership with world-class DSP technology to provide the industry's most advanced ADSL solutions.

ADSL solutions

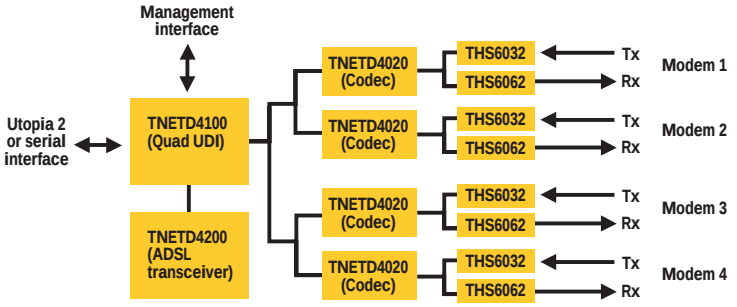
TNETD4000C

TI's central office (CO) ADSL chipset builds on the family's groundbreaking multi-line DSP architecture. Utilizing TI's industry-leading DSP and analog technology, the '4000C chipset allows designers to implement four ADSL modems using a single DSP-based transceiver. This powerful silicon foundation enables some dramatic advantages for CO original equipment manufacturers (OEMs) looking for leading-edge, highly programmable ADSL solutions. The chipset, which includes all of the silicon necessary to implement any combination of four full-rate or G.lite ADSL modems, provides designers the following advanced features. Devices within the chipset include:

TNETD4100: Quad universal digital interface

Provides the user data interfaces for each of the four ADSL modems. The Quad UDI supports either serial or Utopia 2 data interfaces and has on-chip interleave memory for each of the four modems exceeding T1.413 issue 2 and G.992.x requirements and on-chip ARM7 microcontroller and associated memory.

TNETD4000C ATU-C chipset



TNETD4200: ADSL transceiver

Based on TI's industry-leading, 2000 MIPS 'C6000 DSP technology. It performs the ADSL DMT modulation/demodulation for each of the four modems. In addition, all initialization and training sequences of the ADSL specification are handled by the ADSL transceiver.

TNETD4020: ADSL codec

High-performance CO ADSL codec (coder/decoder). The '4020 provides the analog-to-digital and digital-to-analog conversions, along with associated filtering required for standard compliant G.lite or full-rate ADSL designs.

THS6032: Central office line driver

Ultra low-power, differential line driver designed for CO ADSL applications. The THS6032 has a unique Class-G architecture that enables the device to be powered from both low-voltage and high-voltage power supplies. This unique Class-G architecture achieves substantial power savings over traditional line driver architectures.

THS6062: Central office line receiver

High-speed, differential line receiver designed for low-noise, low-distortion ADSL applications.

TNETD4000R

The new TNETD4000R remote terminal ADSL is designed to give OEMs a complete, cost-effective and simplified way of building next-generation remote ADSL solutions. Designed for remote applications such as external modems, small office home office (SOHO) routers and residential gateways, the '4000R builds on TI's leadership in supplying breakthrough solutions for the ADSL industry. The TNETD4000R chipset devices include:

TNETD4150: Universal digital interface

The universal digital interface (UDI) provides the data interfaces (serial or Utopia 2) for the modem. Functions performed by the UDI include bearer channel muxing/demuxing, ADSL framing/deframing, ATM transmission convergence, Reed-Solomon encode/decode, CRC scrambling/descrambling and interleave/deinterleave (8Kbytes on-chip interleave memory).

TNETD4250: ADSL transceiver

The TNETD4250 utilizes TI's industry-leading 'C6000 DSP technology to provide superior performance and unparalleled programmability. The device performs the ADSL digital signal processing and all real-time OA&M and management functions for the modem. Specific digital signal processing includes the control and processing of all initialization/training sequences and the steady state ADSL modem processing. The steady state processing functions include FFT/IFFT, line equalization (FEQ &TEQ) filtering and echo cancellation.

TNETD2011/13: ADSL codecs

The TNETD2011 and '13 are high-performance ADSL codecs that provide a 14-bit analog-to-digital converter, 14-bit digital-to-analog converter and a complete set of digital and analog filters. The '11 device features sets of filters for POTS while the '13 provides the filtering for ADSL over ISDN applications. The set of POTS filters in the '11 are applicable for both full-rate and G.lite implementations.

THS6022: Line driver

A remote terminal line driver, the THS6022 contains two high-speed, high-current drivers capable of providing 250-mA output current (min) into a 50-Ω load. The drivers can be configured differentially to drive a 50-V p-p output signal over low-impedance lines.

THS6062: Line receiver

Using the latest ultra-low noise amplifier technology, the THS6062 consists of two low-noise, high-speed remote terminal line receive amplifiers.

TNETD3000P

The new TNETD3000P ADSL PCI modem chipset is designed to give PC and modem OEMs a complete, cost-effective and simplified way of incorporating ADSL modems into their products. Some of the advanced chipset features include support for both full rate (ITU G.992.1) and G.lite (ITU G.992.2) on a half-sized PCI NIC card, industry-leading interoperability against disparate code at a major service provider's central office and ownership and full support of all technology required for a complete solution. Devices included in the TNETD3000P chipset are:

TNETD3200: ADSL transceiver

Based on the ultra-high-performance 'C6000 DSP core technology, the fully programmable ADSL transceiver leverages the latest 0.18 µm CMOS process. This lowers power consumption dramatically.

TNETD2011: Codec

The TNETD2011 is a high performance ADSL codec that provides a 14-bit analog-to-digital converter, 14-bit digital-to-analog converter and a complete set of digital and analog filters. It features sets of filters for POTS are applicable for both full-rate and G.lite implementations.

THS7002: ADSL receiver

The THS7002 offers low voltage noise and includes 3-bit digitally controlled programmable gain ranging from –22 dB to 20 dB. This allows the incoming ADSL signal to be easily amplified or attenuated to compensate for varying telephone line impedences/lengths. It also includes clamping outputs, shutdown and the preamp pin is accessible for the easy addition of an external filter.

THS6022: Analog line driver

A remote terminal line driver, the THS6022 contains two high-speed, high-current drivers capable of providing 250-mA output current (min) into a 50-Ω load. The drivers can be configured differentially to drive a 50-V p-p output signal over low-impedance lines.

TNETD3100: Universal digital interface

With ADSL framing support for one ADSL modem at the remote terminal, this second-generation digital interface now offers Utopia Level 2 support and integrated ATM TC along with the standard programmable serial interfaces. Interleave memory has also been integrated to reduce the total bill of materials.

Leading-edge hardware and software, proven interoperability and support from one of the industry's most experienced suppliers — all combine to make TI's TNETD3000P chipset a powerful choice.

WHITE PAPER APP REPORT

Logic

LFBGA packaging

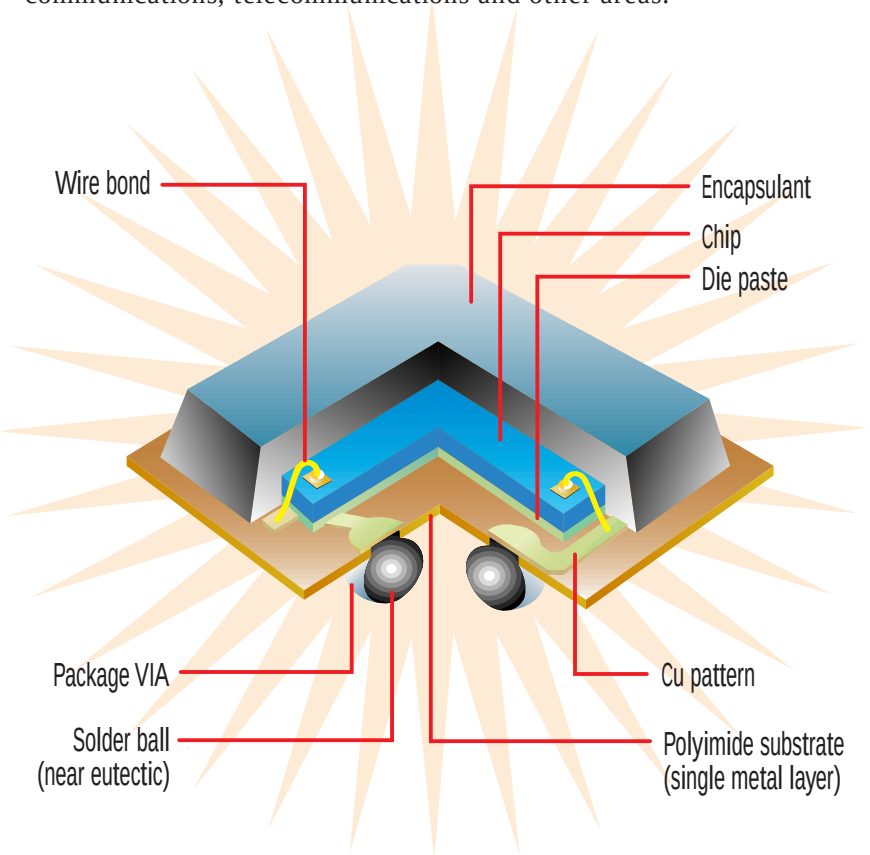
MicroStar BGA™ contains tiny BGA solder alloy balls that make the connection from the chip package to a device or chipboard. These tiny solder balls are more durable than the flexible thin metal leads or pins typically found on chip packages.

Features

- **Increased signal bit width**
- **Reduced board space**
- **Enhanced thermal/electrical performance**

MicroStar BGA™ available for TI logic products

Designers using TI logic products can now enjoy increased signal bit width, reduced board space and enhanced thermal/electrical performance with the 96- and 114-ball MicroStar BGA™. These JEDEC-approved (JC-11 Committee, MO-205), low-profile, fine-pitch ball grid array (LFBGA) packages provide a minimal footprint and can benefit high bit-width (32-/36-bit) applications in PCs and workstations, data communications, telecommunications and other areas.



These packages save the most board space and cost among industry-standard logic packages, reducing space by up to 65 percent over two thin shrink small-outline packages (TSSOPs), while providing the same bandwidth. The 96-ball GKE and 114-ball GKF are designed specifically for logic products and use a flexible substrate, allowing a single package to incorporate any two Widebus™ devices.

LFBGAs also provide the most effective solution for performance issues such as high thermal power dissipation, skew and pin-to-pin inductance. The packages' solder balls act as natural paths for heat conduction, improving thermal performance by more than 30 percent over TSSOPs and thin very small-outline packages (TVSOP).

For highly integrated logic devices, LFBGAs offer more power and ground pins than other packages, providing a clear advantage in ground bounce. Electrical performance is 35 percent better than TVSOPs and more than 50 percent better than TSSOPs. In addition, small impedance variation between pins on the LFBGA package results in lower skew.

The 96- and 114-pin LFBGA form factors also are available from Philips Semiconductor and IDT.

MicroStar BGA™ package footprint comparisons

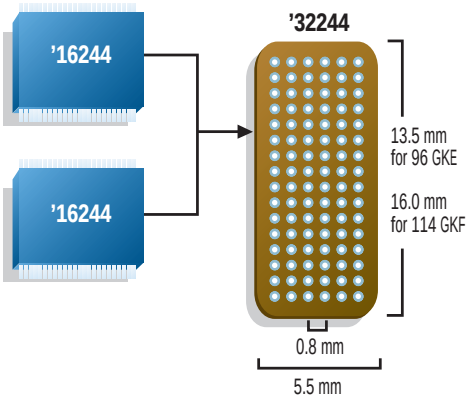
96-ball GKE

Package designator (type)	Footprint area (sq. mm)	Percent savings
One 96-ball GKE (LFBGA)	74.25	—
Two 48-pin DGV (TVSOP)	132.50	44.0%
Two 48-pin DGG (TSSOP)	213.00	65.1%
Two 48-pin DL (SSOP)	342.00	78.3%
One 100-pin PZ (LQFP)	256.00	71.0%

114-ball GKF

Package designator (type)	Footprint area (sq. mm)	Percent savings
One 114-ball GKF (LFBGA)	88.0	—
Two 56-pin DGV (TVSOP)	153.0	42.5%
Two 56-pin DGG (TSSOP)	237.3	62.9%
Two 56-pin DL (SSOP)	394.6	77.7%
One 120-pin PKE (LQFP)	256.0	65.6%

Board reduction with LFBGA



Advanced Low-Voltage CMOS (ALVC)

Device	Description	Availability
SN74ALVCH32501	36-bit universal bus transceiver with 3-state outputs	Released

Low-Voltage CMOS (LVC)

Device	Description	Availability
SN74LVCH32244A	32-bit buffer/driver with 3-state outputs	Released
SN74LVCH32245A	32-bit bus transceiver with 3-state outputs	Released
SN74LVCH32373A	32-bit transparent D-type latch with 3-state outputs	Released
SN74LVCH32374A	32-bit edge-triggered D-type flip-flop with 3-state outputs	Released

Logic news

AVC gains momentum for high-speed logic

The birth of TI's advanced very low-voltage CMOS (AVC) logic family in 1998 gave designers new options for creating future high-performance systems. Offering propagation delays below 2 ns and innovative dynamic output control (DOC™) circuitry for low noise, AVC devices meet the strictest design requirements for high-speed logic.

To date, TI has released the first five AVC devices, including the AVC16835 for PC133 DIMM applications. Additionally, Philips Semiconductor, one of the top 10 semiconductor suppliers in the world, will alternately source AVC devices.

AVC releases

Device	Description
AVC16244	Dual buffers/drivers with 3-state outputs
AVC16245	16-bit bus transceivers with 3-state outputs
AVC16373	16-bit transparent D-type latch with 3-state outputs
AVC16374	16-bit edge-triggered D-type flip-flop with 3-state outputs
AVC16835	18-bit universal bus driver with 3-state outputs

TI qualifies Harris logic families

Since late 1998, Texas Instruments has owned the CD4000, HC/HCT, AC/ACT and FCT/FCT-A device families of the standard logic business that formerly belonged to Harris Semiconductor. TI has been working to qualify the fabrication and assembly of these products at its sites.

More than 90 percent of the Harris devices are now qualified using TI processes and assembly, with completion of the remaining products scheduled for the first quarter of 2000. In cases of product duplication, TI will continue to offer both TI and Harris symbolization.

TI also will assist with customer qualification efforts. Contact your local TI sales office or an authorized distributor for more information. TI offers a number of additional support options to help customers design-in and qualify TI/Harris devices.

Resources

Get the news you need

TI's enhanced, customizable web service delivers the latest TI product information through a personalized news service and individualized web site.

The new TI&ME custom page can be reached by clicking on the TI&ME button from any page on the TI website. This portal provides a personal navigation vehicle to access the TI information that is most relevant to the user.

TI&ME supports all TI businesses: semiconductors, calculators, DLP and materials & controls, and serves investors, media representatives and job seekers. It is also the single point-of-entry into the secure TI extranet sites for customers, distributors, suppliers and third parties. The existing "What's New" page is now a link on the new portal.

Registrants for TI&ME also can choose to receive a personalized e-mail newsletter each week, providing the types of information they requested — no more, no less. To sign up today, visit www.ti.com/sc/techinnovations

TI&ME

Point, click, purchase...

Texas Instruments brings new one-step product ordering online

The Internet first brought customers product information on-demand. Now Texas Instruments and its distributors are using the Internet to make product purchase a seamless digital experience as well.

Visitors to the TI website now can order products directly from TI distributors. With just a few clicks, customers can select a device, check availability and place an order with the distributor of their choice, with no re-entry of data. The new direct response technique saves significant time and effort over many of TI's competitors' sites. These sites typically require gathering device information on the manufacturer's site and then leaving to go to the distributor's site, only to search again and re-enter device and ordering information.

At **www.ti.com**, visitors also can order free samples of selected TI devices, in addition to accessing data sheets, application notes and other technical information already available online.

The new capability — part of TI's strategy to offer customers a complete online experience — is available worldwide and is specific to a customer's region. For example, European design engineers will receive pricing and availability information based on what European distributors have in stock. Likewise, North American distributors will be featured for customers in that region.

The new service is available immediately to customers who have completed a TI&ME website registration. To use this new capability, search for a device on TI's website. Follow the links to the page that displays various resource options including Data sheets, Application notes, Development tools and Pricing/Samples/Availability. Click on Pricing/Samples/Availability. Then, click on Check stock or order under the column labeled Availability/Samples.

Fast access

Digi-Key allows design engineers to order small quantities of TI products

Digi-Key Corporation is now an authorized distributor of TI's semiconductor components in North America. The resulting agreement combines TI's broad array of DSP, analog and logic products with Digi-Key's highly valued services. The agreement will give design engineers expanded access to small reel quantities as well as development systems.

"For the first time Digi-Key will be in a position to offer the engineering community next-day delivery of a broad selection of Texas Instruments components," said Digi-Key President Mark Larson.

Digi-Key offers the full spectrum of TI's commercial semiconductor products. By visiting the Digi-Key website at **www.digikey.com**, design engineers can access real-time product availability and pricing any time. In addition, design engineers researching a particular device on TI's web site will find product availability and online ordering capabilities through a seamless link to Digi-Key's website. Digi-Key also will offer various delivery options for same-day shipment of orders.

Free TI seminar series offers a world of DSP and analog solutions

An upcoming free DSP and analog seminar series from Texas Instruments will allow designers to experience the most advanced techniques for implementing the world's most powerful DSP solutions.

Designers will be able to interface with TI's DSP, analog and mixed-signal and software experts during two-day sessions to be hosted in more than 60 cities worldwide. The first day of the seminar will explore DSP technology, while the second will cover analog and mixed-signal technology. Although each day's content is complete and stand-alone, designers who choose to attend both days will receive a full overview of both technologies.

Topics for the DSP session include a DSP primer, individual system requirements, TI's leading-edge DSPs and a look at how DSP technology will affect future applications. The analog and mixed-signal topics will include the interfaces between different analog components and the interfaces between analog and digital components in a typical signal processing application, as well as design issues, system considerations and product selection.

The series presents an opportunity for design engineers to experience the latest technology in these exciting fields and to see TI's leading-edge products. To register for the free seminar or to get more information, visit the TI web site at **www.ti.com/sc/techinnovations**

1999 seminar schedule

USA & CANADA

Oct. 11-12	Boston, MA
Oct. 11-12	Detroit, MI
Oct. 12-13	Dayton, OH
Oct. 13-14	Milwaukee, WI
Oct. 14-15	Minneapolis, MN
Oct. 18-19	Meriden, CT
Oct. 18-19	Orlando, FL
Oct. 19-20	Chicago, IL
Oct. 19-20	Dallas, TX
Oct. 20-21	Houston, TX
Oct. 21-22	Austin, TX
Oct. 21-22	Ottawa, ON
Oct. 25-26	Calgary, AB
Oct. 25-26	Rochester, NY
Oct. 26-27	Vancouver, BC
Oct. 27-28	Boulder, CO
Oct. 27-28	Toronto, ON
Oct. 28-29	San Jose, CA
Nov. 1-2	San Diego, CA
Nov. 1-2	Seattle, WA
Nov. 2-3	Irvine, CA
Nov. 2-3	Portland, OR
Nov. 3-4	Baltimore/Washington
Nov. 3-4	Woodland Hills, CA
Nov. 4-5	Phoenix, AZ
Nov. 4-5	Summit, NJ
Nov. 8-9	Philadelphia, PA
Nov. 9-10	Long Island, NY

EUROPE & MIDDLE EAST

Oct. 18-19	Munich, Germany
Oct. 18-19	Reading, UK
Oct. 19-20	Birmingham, UK
Oct. 19-20	Frankfurt, Germany
Oct. 20-21	Duesseldorf, Germany
Oct. 20-21	Leeds, UK
Oct. 20-21	Milan, Italy
Oct. 25-26	Aarhus, Denmark
Oct. 25-26	Paris, France
Oct. 26-27	Lyon, France
Oct. 26-27	Oslo, Norway
Oct. 27-28	Rome, Italy
Oct. 27-28	Stockholm, Sweden
Oct. 28-29	Helsinki, Finland
Nov. 3*	Sofia, Bulgaria
Nov. 4*	Ljubljana, Slovenia
Nov. 8-9	Zurich, Switzerland
Nov. 9-10	Brussels, Belgium
Nov. 10-11	Maarssen, Netherlands
Nov. 11-12	Istanbul, Turkey
Nov. 15-16	Tel Aviv, Israel
Nov. 16-17	Haifa/Israel
Nov. 22*	Portugal
Nov. 23-24	Madrid, Spain
Nov. 24-25	Barcelona, Spain

LATIN AMERICA

Nov. 8-9	Porto Alegre, Brazil
Nov. 10-11	Sao Paulo, Brazil
Nov. 16*	Buenos Aires, Argentina
Nov. 16-17	Guadalajara, Mexico
Nov. 18-19	Monterrey, Mexico
Nov. 18-19	Santiago, Chile

** Where only one date appears, TI will present a limited, DSP-oriented seminar only.*

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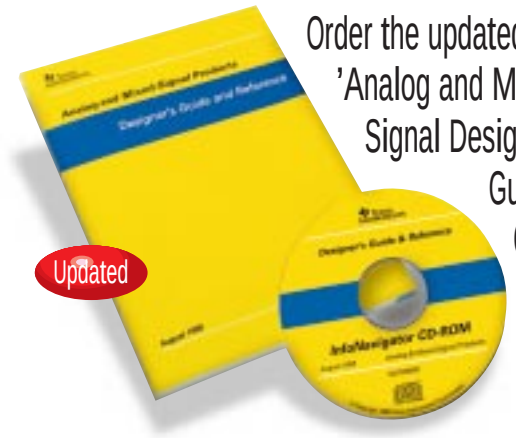
Free info

Move products to market faster with help from TI's new 'Analog Applications' book

See page 24 for details.



Order the updated 'Analog and Mixed-Signal Designer's Guide' and CD-ROM

See page 24 for details.

Learn advanced techniques for implementing DSP solutions at TI's free DSP and Analog Seminar series

See page 31 for details.

technology innovations

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