INTEGRATION

www.ti.com/sc/9812

ON THE WEB

New online capability creates convenience for customers

Texas Instruments and authorized distributors have created a seamless Web process that makes doing business with TI easier.

Customers can now order and check product availability among multiple distributors from a single location on TI's website www.ti.com. When design engineers select a device, they can check availability and place orders with the distributor of their choice in about three clicks.

The capability is the newest feature of TI's already fast and effective Internet services, which provide data sheets, application notes and other technical documentation online. It is made possible through TI's TI&ME, an electronic service in which designers can register to receive information about TI's products customized for their needs.

The new availability/order service is being implemented worldwide and features leading distributors. Through TI&ME registration, design engineers receive customized information based on their locations. For example, customers in North America get informa-

All in one

New integrated development environment cuts coding time

A new software development environment from Texas Instruments will give designers who work with digital signal processors (DSPs) a big advantage — more time to focus on their applications. Code Composer Studio™, expected to be available early next year for the TMS320C6000, is a comprehensive integrated DSP software development environment. It offers real-time analysis capabilities, advanced visualization and an architecture that invites plugs-ins from third-party developers.

Avnet expands TI tools and support

Designers can try before they buy development tools through a loaner program offered by Avnet Electronics Marketing and Texas Instruments.

The Tools Demo Pool, provided by Avnet's Technical Support Center and field application engineers (FAEs), loans customers TI development tools to help them make the right choices before investing in the equipment.

The program also gives designers valuable hands-on experience before training so they can get the most out of technical courses and seminars offered by TI and Avnet.

By contacting a local Avnet sales team, customers can request tools or get help selecting the appropriate products and corresponding support

tools. Qualified customers are given loaners for a free 30-day period to facilitate their design decisions.

Avnet also offers Avnet Design Services, a suite of focused engineering and technical services ranging from simple component evaluations and recommendations to code writing and full turnkey engineering. The services provide complete product solutions to the engineering community. ■

➜ **For more information, call (800) 332-8638 for locations and local phone numbers or visit website www.em.avnet.com/semi.**

Avnet's Demo Pool

Inventory is updated constantly to keep up with the latest DSP technology. Here's a list of available tools:

■ **TMS320C2x:** DSP Starter Kit, Simulator Software, C Compiler Tools

■ **TMS320C2000:** C Compiler Tools, XD510 PC C Source Debugger, Pathway DSK Pathway DSP Starter Kit, 'C203-based Working Reference Design Kit, Motion Control Kit (MCK) 240

■ **TMS320C3x:** Simulator Software, C Compiler Tools, EVM Board, XDS510 PC C Source Debugger

■ **TMS320C4x:** C Compiler Tools

■ **TMS320C5x:** DSK Starter Kit, XDS510 PC C Source Debugger, C Compiler Tools, EVM with Assembler/Linker

■ **TMS320C5000:** XDS510 PC C Source Debugger, PC Simulator, 'C54x Code Generation Tools, 'C54x EVM Board

■ **TMS320C6000:** Code Generation Tools, C Source Debugger/Simulator, Code Generation Tools

■ **TMS320C8x:** Software Development Board Kit

■ **DS510 JTAG/PC Controller Kit**

New amplifiers offer design benefits

Op amps

A new family of low-power rail-to-rail input/output operational amplifiers deliver exceptional output drive, AC performance and low noise. The TLV246x devices, which offer simplicity of evaluation and design-in, are ideally suited for portable equipment, cellular, telecommunications, data acquisition and signal conditioning applications.

TI's TLV246x family features rail-to-rail I/O operation through extended common mode input range, which exceeds the supply rails by 200 mV, and output drive that will source and sink more than +/−90 mA. This exceptional output drive overcomes a major limitation of older rail-to-rail I/O amplifiers. In addition, the 11 nV/√Hz noise floor and 100-mV input offset voltage are among the industry's lowest. The devices operate over a supply voltage range of 2.7 V to 6 V.

Highlights of the TLV246x family's AC performance include 4.4 MHz bandwidth and 1.8-V/µs slew rate. To prolong battery life in portable applications, the devices include a

shutdown capability that minimizes supply current to an ultra-low 0.6 µA/channel and places the output in a high impedance state.

Customers can receive, at no charge, TI's innovative new Universal Op Amp Evaluation Module, which accelerates evaluation of single and dual versions of TI's op amps, including those in the TLV246x family.

The TLV246x family includes single,

dual and quad amplifier members, available with and without shutdown. All are fully specified at 3 V and 5 V. Package and temperature options include SOT-23, MSOP, TSSOP, SOIC and PDIP. All TLV246x devices are characterized for operation from 0° C to 70° C and −40° C to 125° C. ■

➡ For complete information, order: **Sample Pack (SLOP222)** and **EVM Boards (SLOP225)**. See page 8.

A close look at the TLV246x product family

Device	Price	Availability
TLV2460 (single, shutdown)	$.72	Now (SOT-23 in Jan. '99)
TLV2461 (single, no shutdown)	$.62	Now (SOT-23 in Dec. '98)
TLV2462 (dual, no shutdown)	$1.03	Now (MSOP in Dec. '98)
TLV2463 (dual, shutdown)	$1.13	Now (MSOP in Dec. '98)
TLV2464 (quad, no shutdown)	$1.65	Now
TLV2465 (quad, shutdown)	$1.75	Now

Suggested resale pricing in U.S. dollars in 1K quantity.

Audio power amps

Four new stereo audio power amplifiers (APAs) offer designers greater flexibility in choosing the desired levels of power consumption and fidelity for their systems.

The new offerings include the TPA152, a single-ended APA that delivers clean, crisp sound to high-fidelity stereo headphones for portable compact disc (CD) players, notebook computers and voice recorders. The TPA152 also serves as an output buffer for audio coder/decoders (codecs) in PCs and in applications where a high-performance headphone/line-out amplifier is needed.

In addition, the new TPA102, TPA112 and TPA122 (TPA1x2) APAs provide high-quality stereo output with low-power consumption for 32-Ohm headphones. The TPA1x2 devices feature common APA pinouts to facilitate the enhancement of existing battery-operated designs with the use of these components.

With an extremely low total harmonic distortion plus noise (THD+N) of less than 0.02 percent at 1 kHz, the TPA152 is among the highest-fidelity solutions available for driving headphones. For 10-kilo Ohm loads, THD+N drops to just 0.005 percent at 1 kHz. With an output drive of 75 milliWatts (mW) per channel into a 32-Ohm load, the TPA152 is well suited for use in a variety of mobile, desktop and consumer applications.

The other members of the family operate from a supply of 2.5 V to 5 V. Each device

delivers 150 mW of stereo output from an ultra small MSOP package. The TPA102 and TPA122 are optimized for PC power supplies and offer a shutdown mode that minimizes supply current to 60 micro Amps. The TPA112 is optimized for audio applications that require a standard op amp pinout.

TI's TPA152, TPA102, TPA112 and TPA122 are available now from TI and

authorized distributors. Evaluation modules (EVMs) are available for the devices. For details, check website **www.ti.com/sc/docs/msp/tools/ audio.htm**. ■

PowerPAD is a trademark of Texas Instruments.

➡ For complete information, order: **Data Sheets (SLOS213, SLOS212 and SLOS211)**. See page 8.

Available APA devices

TI offers an APA solution to meet most portable design needs.

Device	Description	Packages	Price
TPA102	150 mW stereo, SE	8-pin MSOP*	$.64
TPA112	150 mW stereo, SE	8-pin SOIC/MSOP*	$.50/.64
TPA122	150 mW stereo, SE	8-pin SOIC/MSOP*	$.50/.64
TPA152	75 mW stereo, SE	8-pin SOIC	$.77
TPA301	350 mW mono, BTL	8-pin SOIC/MSOP*	$.67/.91
TPA311	350 mW mono, SE/BTL	8-pin SOIC/MSOP*	$.86/1.16
TPA4861	1 W mono, BTL	8-pin SOIC+	$1.19
TPA4860	1 W mono, BTL	16-pin SOIC with headphone sense	$1.24
TPA0202	2 W stereo, SE/BTL	24-pin TSSOP*	$2.82
TPA0102	1.5 W stereo, SE/BTL	24-pin TSSOP*	$2.53
TPA0103	1.75 W 3-channel stereo, SE/BTL	24-pin TSSOP*	$2.53
TPA302	300 mW stereo, SE	8-pin SOIC+	$1.19
TPA1517	6 W stereo, SE	20-pin SOIC*/DIP+	$1.45
TPA005D02	2 W Class-D stereo	48-pin TSSOP*	$3.48

SE = single-ended   BTL = bridge-tied load   * PowerPAD™ package   + Thermally enhanced package
Suggested resale pricing in U.S. dollars in 1K quantity.

Code Composer Studio

Code Composer Studio combines the most advanced DSP software tools technologies, reducing the average DSP coding time by up to 50 percent and easing many complexities of DSP development. For designers, that means more time to concentrate on those elements that differentiate their products and deliver value to customers. Designers will be able to bring applications such as wireless base stations, remote access servers, digital subscriber loop systems, high-end visioning and imaging systems and voice-over-packet to market more easily, more reliably and with increased capabilities.

As a development environment, Code Composer Studio extends and integrates the capabilities of the Code Composer Integrated Development Environment (IDE), DSP/BIOS and Real-Time Data Exchange (RTDX™) technologies and the TI C compiler, assembly optimizer and linker — all within an extensible architecture. This open host environment encourages development of specialized third-party tools and plug-ins that support a variety of application specific expertise, further reducing time and resources spent developing customized utilities.

Key capabilities include real-time analysis and debugging coupled with advanced data visualization. These features permit designers to view data from a running DSP application without stopping execution, allowing the application signals and data to be viewed intuitively and naturally as images instead of text. This feature makes it easier and quicker to identify real-time problems in the applications.

Code Composer Studio is scheduled to be available on PCs (Windows™ 95/98/ NT™) in 1Q99 for $2,995. ■

Suggested resale pricing in U.S. dollars. Code Composer Studio is a trademark of Texas Instruments. Windows and Windows NT are trademarks of Microsoft Corp.

➡ For complete information, order: **Brochure (SPRB128)**. See page 8.

More solutions to come

Software solutions are becoming increasingly important in designing today's and tomorrow's applications. TI understands this demand and is always working to stay ahead with innovative software products. To keep up with TI's advances, visit (and bookmark) website **www.ti.com/sc/ studio**.

Third-party plug-ins extend robust development environment

Code Composer Studio provides standard open Application Program Interfaces (APIs), allowing third parties to build higher-level products specific to their core competency and add value and functionality to the environment.

More than 20 third parties have committed to support development of plug-ins meeting specific application needs for the Code Composer Studio environment. These tools extend the current environment so designers can develop more robust DSP applications faster and easier. Several plug-in demonstrations are available. ■

➡ For complete information, see **www.ti.com/sc/9812**.

To see how it works, go to www.ti.com.

➡ Click on "Design Engineers" or "Semiconductors" then select one of the specialized searches based on part number, device parameters or product family tree.

➡ After selecting the part, choose "Check stock or order" under the "Availability/Samples" column. Customers who are registered with TI&ME will link to a page that contains phone numbers and Web links to distributors in their country or region carrying their selected part. Those who are not registered will be able to fill out a short form and upon completion will automatically receive the customized information.

Online

tion about North American distributors; customers in Europe find out what's available through European distributors. Once connected to a distributor's page, the customers don't have to re-enter information; they're automatically linked to the site that allows them to order the specific part they've requested.

Like TI&ME, this new service is a way for TI to help customers save time during purchasing, development, prototyping and production stages of designing with TI products. It also exemplifies TI's efforts in working with distributors to meet customers' needs, regardless of their organizations' size. ■

DSP SOLUTIONS

Power savers

TI expands the industry's lowest-power DSP platform

Two new power-efficient, ultra-small DSPs from Texas Instruments will help drive development of the next generation of cellular telephones, hand-held computers, personal digital assistants (PDAs) and dozens of other portable and telecommunications products. The TMS320C5420 offers 200 MIPS and the industry's lowest power rating, while the TMS320C5402 is the industry's lowest-cost solution at $5 per MIPS (in 50K quantities).

The 'C5420 packs two DSP cores, 200 MIPS, 200K words of on-chip SRAM memory and a complement of peripherals including six serial ports, a direct memory access (DMA) controller and a 16-bit host port interface (HPI). Even with all this functionality, the device consumes less than 200 mW at 200 MIPS, giving it the lowest power consumption figure in the industry. The 'C5420 is the most highly integrated, fixed-point DSP available today, answering the high-performance, low-power consumption and small-space needs of high-end, multichannel infrastructure equipment like base stations, remote access servers (RAS) modems and computer telephony systems.

The new 'C5402 provides the industry's most cost-effective, general-purpose solution for single-channel, end-user terminal systems such as wireless modems, next-generation PDAs, Ethernet phones and other telephony applications. The 100-MIPS device features 16K words of on-chip SRAM, 4K words of ROM and intelligent peripheral capabilities including two multichannel buffered serial ports

(McBSP), a bit I/O interface, a DMA controller and an independent HPI.

Both devices are supported by a comprehensive selection of development tools. Designers who want to upgrade from TI's 'C5x generation to the high-performance 'C54x DSPs can also download a free, 60-day trial of the Translation Assistant Program (TAP5000) from the TI website, along with the 'C5000 Evaluation Tools for a 30-day, free trial period.

Availability

'C5420 samples are scheduled for availability this month, with production volumes expected 2Q99. Samples of the 'C5402 are scheduled for 1Q99, with production volumes expected 2Q99. Both devices come in TI's microStar™ 12 x 12 x 1.4 mm ball grid array (BGA) package. ∎

TMS320C5420	$55
TMS320C5402	$5

Suggested resale pricing in U.S. dollars in 50K quantities.

microStar is a trademark of Texas Instruments.

➜ **For complete information, order: Product Bulletin (SPRT121E).** See page 8.

The TMS320C5420 offers 200 MIPS and the industry's lowest power rating, while the TMS320C5402 is the industry's lowest-cost solution.

Online training

A comprehensive web-based training course on digital signal processing is available on TI's website. Designing with the 'C54x DSKplus is the first in a series of planned courses designed to reduce DSP-based product design and development time. Through the website, students can learn how to perform digital signal processing on one of TI's popular DSPs, the 'C54x, by using a simple tool, the DSP Starter Kit (DSK). The online training program allows students to progress through the course in a self-paced, self-customized environment, at any time from any computer connected to the Web and with a Web browser.

The four- to six-hour introductory course is centered around the 'C54x DSKplus, an innovative DSP starter kit that allows students to explore the architecture and operation of the TMS320C54x CPU and its peripherals by loading and running their own software. It provides an overview of the theory and future direction of DSP technology. The course also "walks" students through installing the DSK, using DSKplus to implement a filter algorithm and other DSP-related programs and implementing code that takes advantage of the 'C54x's powerful instruction set.

Designing with the 'C54x DSKplus was developed by TI and delivered by DigitalThink, the leader in web-based training. The course costs $200. ∎

➜ **For complete information, see:** www.ti.com/sc/9812.

Translation Assistant Program: Simplifying the upgrade to the 'C54x

TI's 'C54x DSPs are optimized to meet the performance, cost and low-power needs of wireless and wireline communication systems. With up to 200 MIPS performance and the lowest power dissipation in the industry, the highly efficient 'C54x architecture enables the convergence of voice and data demanded by today's communications applications, as well as emerging applications like IP phones and portable information appliances. As wireless and wireline applications grow in performance and low-power requirements, the 'C54x DSPs are a natural migration from TI's existing 'C5x devices because of the compatibility between the two generations.

For DSP customers looking to upgrade to the higher performing TMS320C54x, TI has developed the Translation Assistant Program (TAP5000), which protects customers' existing code investment by allowing them to easily convert their DSP application from a 'C5x to a 'C54x.

The TAP5000 is a robust and graphically oriented tool that enables up to 90 percent automatic translation by obtaining efficient, high-performance code from the existing 'C5x assembly code. For the portions of code not automatically translated, the tool provides a highly interactive environment to assist the user in any manual conversion.

The TAP5000 is available free to 'C5x clients through a download from TI's website at www.ti.com/sc/docs/dsps/tools/ftools/index.htm.

➜ For complete information, order: **TMS320C5000 Evaluation Tools CD-ROM (SPRC022).** See page 8.

Emerging application: DSP-based Voice-over-Internet Protocol

Voice-over-Internet Protocol (VoIP) is one example of an emerging application that will benefit from TI's DSPs, particularly the new 'C54x devices.

Shifting voice traffic from traditional telephone networks to well-managed IP-based data networks is a growing trend that provides advantages such as system efficiency and lower calling costs.

DSPs are at the core of the voice and data network infrastructure, and TI, the world leader in DSPs, is also the DSP leader in the VoIP market. A DSP-based VoIP system or gateway makes a shift to data networks possible, serving as the bridge between the public switched telephone network (PSTN) and the packet network. VoIP gateways allow users to speak on regular phones or send information over regular fax machines as they bypass PSTN toll charges with no perceivable loss of quality.

DSP advancements in processing horsepower, smaller footprint packaging and reductions in power dissipation have expanded the number of channels carried on VoIP gateways and embedded in network backbones. These advancements are transforming a technology, once used primarily to obtain free phone calls through a PC and the public Internet. ∎

When designing with digital signal processors (DSPs) from Texas Instruments, you don't have to spend much time figuring out which data converter to use in your application. TI has done all of the work for you, saving you precious design time. **In fact, TI's data converters** are designed for TI's powerful DSPs. The newest analog-to-digital converters (ADCs) and digital-to-analog converters (DACs) provide glueless interfaces to the TMS320 DSPs. **Here's a look at the latest offerings.**

Data

High-speed voltage-output DACs

Two new 12-bit voltage-output DACs deliver conversion speeds that eliminate the need to use current-output DACs and external buffers for current-to-voltage conversion. The TLV5613 and TLV5619 both feature 1-μs typical settling time while operating from a single wide supply range of 2.7 V to 5.5 V.
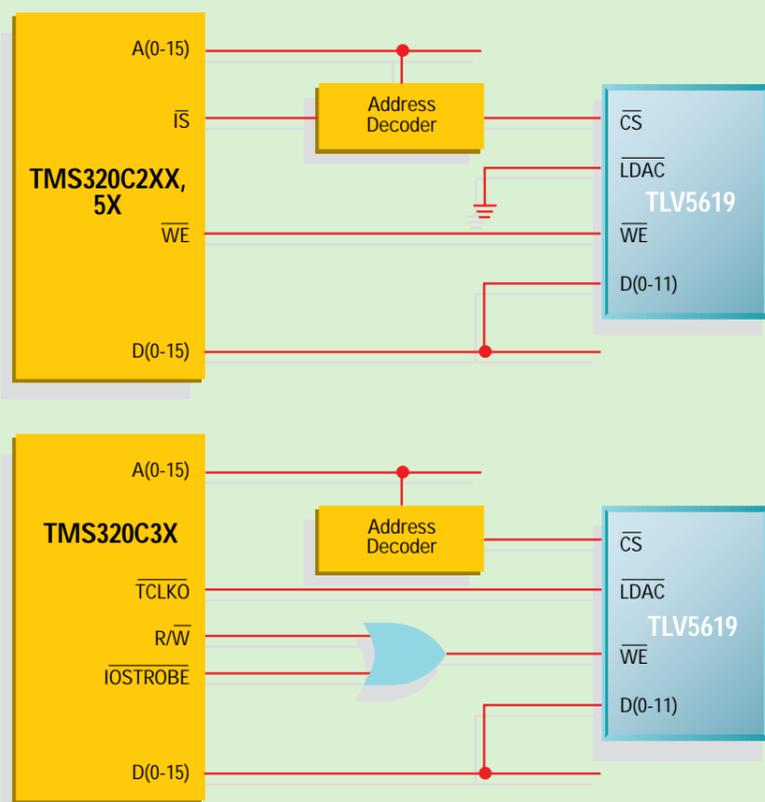
The TLV5613 features a parallel bus compatible with most 8-bit microprocessors, while the 12-bit interface of the TLV5619 is compatible with TMS320 DSPs and microprocessors. In both devices, input data is double buffered so that outputs can be updated asynchronously. The output is buffered by a high-speed, rail-to-rail amplifier, while having a settling time as low as 1-μs.

The TLV5613 has a low power mode, power-down mode and two address lines that determine whether inputs are LSB, MSB or control data. Both DACs are well suited for applications such as telecom line cards, mass storage, zip drives, industrial process control and battery-powered test instruments.

The TLV5613 and TLV5619 are available in 20-pin SOIC and TSSOP packages for commercial and industrial temperature ranges. Suggested resale pricing per unit in quantities of 1,000 is $3.90 (U.S. dollars) for the TLV5613 and the TLV5619. ∎

➜ **For complete information, order: Data Sheets (SLAS174A, SLAS172B). See page 8.**

TLV5613 features

- 8+4-bit interface
- 1 μs/4.2 mW (fast mode)
- 3.5 μs/1.2 mW (slow mode)
- Power-down mode (10 nW)
- 2.7-V to 5.5-V single supply

TLV5619 features

- 12-bit TMS320 DSP-compatible interface
- 1 μs settling time (typ)
- 4.3 mW for 3-V supply
- 2.7-V to 5.5-V single supply

Variable-speed serial DACs

The TLV5604, TLV5614 and TLV5616 are 10- and 12-bit serial voltage-output DACs that feature programmable settling times as fast as 3 μs (typ) at 5 V, allowing designers to choose the appropriate speeds for their applications.

The three devices are designed for low power consumption to extend battery life and dissipate less heat, with the TLV5616 typically dissipating only 900 mW in the slow mode at 3 V. All of the converters come with a power-down feature to save energy when they are not being accessed.

Support for supply voltages from 2.7 V to 5.5 V enables a wide range of applications. A glueless interface to TMS320, SPI, QSPI and Microwire serial ports simplifies design.

The resistor string output voltage is buffered by an x2-gain rail-to-rail output buffer. For flexibility in design, the TLV5604 and TLV5614 have a separate supply for the digital serial interface and DACs. These two devices also can update multiple DACs simultaneously.

All three devices are suited for battery-powered test instruments, industrial process controls, machine and motion control devices, communications, digital servo control loops, mass storage devices and a variety of other applications.

The TLV5604 and TLV5614 are available in 16-pin SOIC and TSSOP packages, and the TLV5616 in an 8-pin SOIC package. Suggested resale pricing per unit in quantities of 1,000 is $4.90 for the TLV5604, $9.50 for the TLV5614 and $3.15 (U.S. dollars) for the TLV5616. ∎

➜ **For complete information, order: Data Sheets (SLAS176A, SLAS188, SLAS152A) and Application Report (SLAA034). See page 8.**
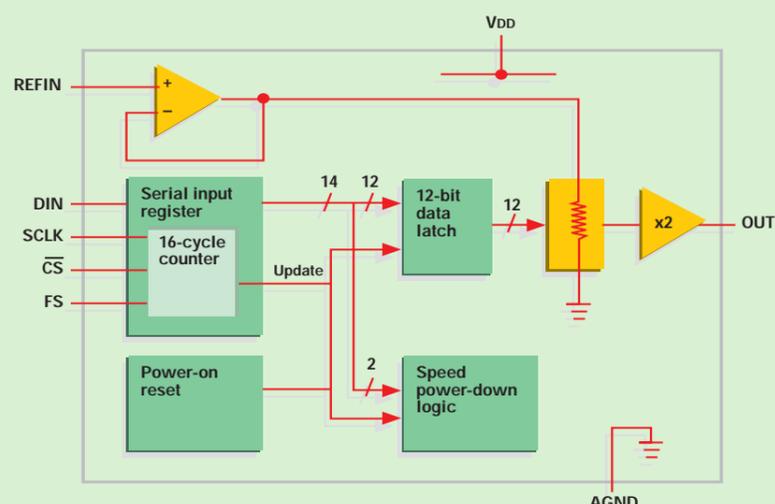
TLV5604 features

- 10-bit voltage output quadruple DAC
- Programmable settling time vs. ultra-low power: 2.5 μs/9 mW (typ), 8.5 μs/3 mW (typ)
- Dual 2.7-V to 5.5-V supply (separate digital and analog supplies)

TLV5614 features

- 12-bit voltage output quadruple DAC
- Programmable settling time vs. power: 3 μs/9.6 mW (typ), 9 μs/3.6 mW (typ)
- Dual 2.7-V to 5.5-V supply (separate digital and analog supplies)

TLV5616 features

- 12-bit voltage output DAC
- Programmable settling time vs. ultra-low power consumption: 3 μs/2.1 mW (typ), 9 μs/900 mW (typ)
- Single 2.7-V to 5.5-V supply

Converters

Low-power programmable ADC

The TLV1562, a high-speed, low power ADC with programmable resolution, redefines system design for DSP applications. The device provides flexibility for portable digital radios, paging systems, process and motor controls, remote sensing, automotive systems, servo controls and communications systems such as wireless local loops.
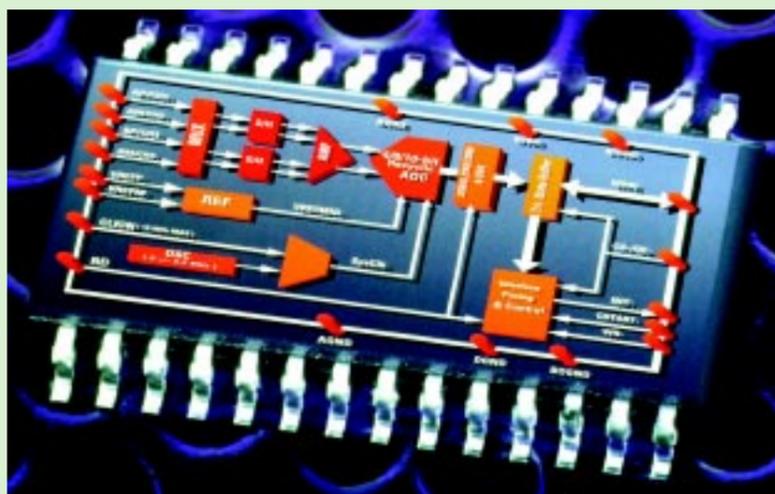
The resolution and sampling speed of the TLV1562 can be programmed to change dynamically during operation. A unique recyclic dual sample/hold (S/H) architecture enables the device to digitize a continuous signal or provide low interrupt latency depending on system needs. The dual S/H, with shared amplifier and ADC, provides two matched channels and can be configured to allow automated multichannel data acquisition that requires minimal host intervention.

The device provides either binary code or two's complement code. This offloads the code conversion function from the DSP. The device is well suited for undersampling applications with a wide input bandwidth of 75 MHz at –1 dB and >120 MHz at –3 dB. Programmable conversion modes, both interrupt-driven and continuous, support optimization for MIPS-sensitive applications.

Power consumption as low as 6 mA at 2.7 V or 10 mA at 5.5 V extends battery charges, and a DSP- and microprocessor-compatible interface simplifies design. The TLV1562 is available in 28-pin TSSOP and SOIC packages with suggested resale pricing of $4.51 (U.S. dollars) per unit in quantities of 1,000. ■

➡ **For complete information, order: Data Sheet (SLAS162). See page 8.**

TLV1562 features

- Reconfigurable:
  2 MSPS @ 10 bit,
  3 MSPS @ 8 bit,
  7 MSPS @ 4 bit
- Wide input bandwidth
  for undersampling:
  120 MHz @ –3 dB
- Low operating supply
  current: 10 mA @ 5.5 V,
  6 mA @ 2.7 V
- Extensive power-down
  features including S/W
  PWDN and auto PWDN
- Simultaneous sample
  and hold
- Programmable conversion
  modes
- Programmable single-ended/
  differential inputs

The resolution and sampling speed of the TLV1562 can be programmed to change dynamically during operation. A unique recyclic dual sample/hold (S/H) architecture enables the device to digitize a continuous signal or provide low interrupt latency depending on system needs.

High-speed serial ADC

The industry's fastest 10-bit serial ADC simplifies design with a glueless interface to TMS320 DSPs and industry-standard microcontrollers. The eight-channel TLV1570 ADC provides high performance and design flexibility, accepting analog inputs from 0 to 5.5 V and digitizing 1.25 million samples per second (MSPS) at 5 V and 625 kSPS at 3 V.

With single-supply operation from 2.7 V to 5.5 V, the TLV1570 features a programmable internal voltage reference of 2.3 V or 3.8 V. An internal MUX is independently accessible, allowing the use of a signal conditioning circuit for all eight channels. Programmable auto-scanning allows selection of channel access. Power dissipation as low as 8 mW, plus 175-µA auto-power-down and 3-µA software power-down modes, help extend battery charges life.

Typical Integral Non-Linearity (INL) of +/–0.65 LSB ensures accuracy for the most demanding applications. The TLV1570 can benefit process control, motor control, various automotive systems, digital servos, portable test instruments, mass storage and image sensor processing applications.

The TLV1570 is available in 20-pin SOIC and TSSOP packages with suggested resale pricing of $3.70 (U.S. dollars) per unit in quantities of 1,000. ■

➡ **For complete information, order: Data Sheet (SLAS169A). See page 8.**

TLV1570 features

- Fast throughput: 1.25 MSPS
  at 5 V, 625 kSPS at 3 V
- Eight analog input channels
- Low power dissipation:
  40 mW at 5 V, 8 mW at 3 V
- Wide analog channel input:
  0 V to AVDD
- Programmable internal
  reference voltage
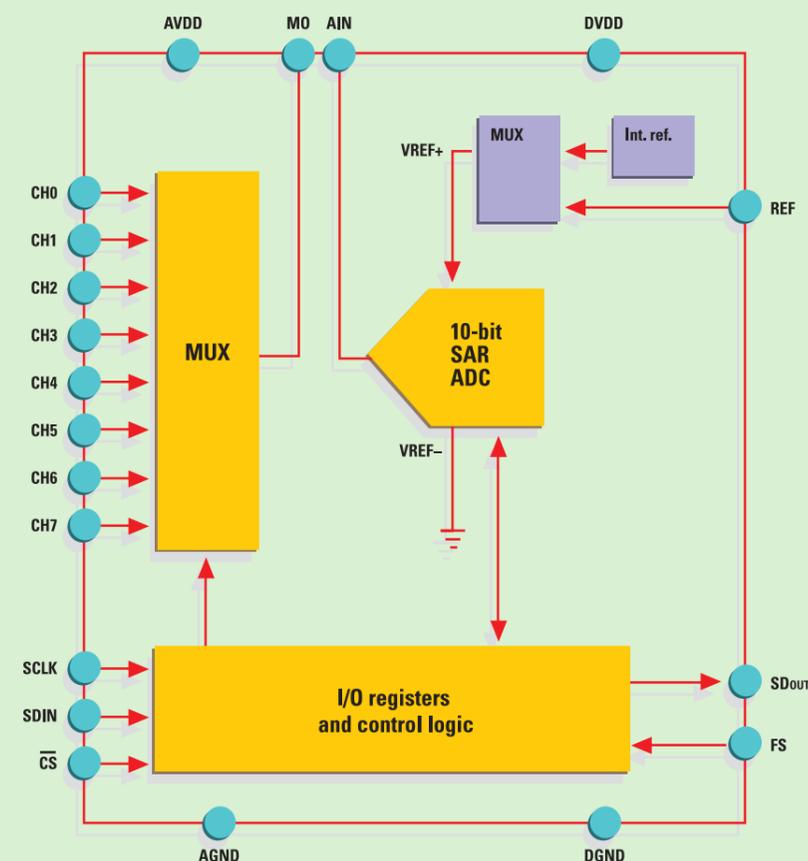
Data Converters

ABSTRACTS

More data on converters: Find answers to some of your design questions and challenges in these recently published TI articles.

ADCs and DACs trade off performance and resolution

By Kush Parikh, Technical Sales Representative

Analog-to-digital (A/D) converters and digital-to-analog (D/A) converters provide the real-world interface for digital signal processing systems. In applications such as multimedia PCs and wireless communications, a converter's performance is vital to the performance of the entire system. Two key performance criteria are sampling speed and bit resolution or precision. In many cases, designers face a trade-off between these criteria. Different types of converter architectures offer system designers a range of choices in speed and resolution for optimal use in their applications. Among the choices in A/D architectures are flash, pipeline, successive-approximation register and sigma-delta converters. D/A architectures include resistor converters (resistor-string and R-2Rs) and current-mode converters (current-steering single-ended, current-mode-differential and continuously calibrating). This article explains the design trade-offs of each of these types of converter architectures. For the complete article, see: **www.ti.com/sc/9812**.

Excerpted from an article that appeared in the April '98 issue of Electronic Products.

Defining the data converter frontiers

By Tom Lahutsky, New Product Development Manager, Data Converters, Mixed Signal Products Group

Recent advances in digital signal processing (DSP) solutions have brought real-world sights and sounds into the domain of digital equipment. You can watch and listen to events live on your PC over the Internet. You can listen to CDs, talk on wireless phones and play some incredibly realistic video games.

None of that would be possible without increasing innovation in ADC and DAC technology. Data converters provide the two required bridges between the analog and digital worlds. As a result, data converters pose interesting and challenging trade-offs relative to integration and process technology. Should a device be developed in an analog or digital CMOS, bipolar or BiCMOS process is a key question to data converter designers. There are two frontiers that are continually being pushed forward: The integration frontier and the leading-edge frontier. What determines these frontiers? They're all about speed, resolution and market demand. For the complete article, see: **www.edtn.com/analog/tom.htm**.

Excerpted from a column that appeared in Analog Avenue, an online EDTN publication.

MATCHMAKERS

Help with choosing the right data converter for your DSP applications is just a few mouse clicks away. TI provides the answers online in a series of charts that match TI's ADCs and DACs to the TMS320 DSP families 'C2000, 'C3x, 'C5000 and 'C6000. For complete information, visit TI website **www.ti.com/sc/select**.

Analog-to-Digital converters for the 'C2000

ADC	Resolution	Sampling rate	Power (mW)	Parallel or serial	No. of inputs	Supply volt. (V)
TLC540	8 bits	75 kSPS	6	S	11	5
TLC541	8 bits	40 kSPS	6	S	11	5
TLC542	8 bits	25 kSPS	6	S	11	5
TLC545	8 bits	76 kSPS	6	S	19	5
TLC546	8 bits	40 kSPS	6	S	19	5
TLC548	8 bits	45 kSPS	8	S	1	5
TLC549	8 bits	40 kSPS	8	S	1	5
TLC876	10 bits	20 MSPS	107	P	1	3/5
TLC1540	10 bits	32 kSPS	6	S	11	5
TLC1541	10 bits	32 kSPS	6	S	11	5
TLC1542	10 bits	38 kSPS	4	S	11	5
TLC1543	10 bits	38 kSPS	4	S	11	5
TLC1549	10 bits	38 kSPS	4	S	11	5
TLC1550	10 bits	164 kSPS	10	P	1	5
TLC1551	10 bits	164 kSPS	10	P	1	5
TLC2543*	12 bits	66 kSPS	5	S	11	5
TLC5510*	8 bits	20 MSPS	90	P	1	3.3
TLC5540*	8 bits	40 MSPS	85	P	1	5
TLV1543	10 bits	38 kSPS	4	S	11	3.3
TLV1544*	10 bits	85 kSPS	3	S	4	5
TLV1548*	10 bits	85 kSPS	3	S	8	3/5
TLV1570	10 bits	1.25 MSPS	8	S	8	3/5
TLV1572*	10 bits	1.25 MSPS	8	S	1	3/5
TLV2543*	12 bits	66 kSPS	3.3	S	11	3.3

* Evaluation module available

Digital-to-Analog converters for the 'C2000

DAC	Resolution	Settling time (μs)	Power (mW) typ.	Parallel or serial	Supply volt. (V)	Output (V or I)	No. of DACs
TLC5615	10 bits	12.5	1.3	S	5	V	1
TLC5617A	10 bits	2.5-12.5	8.8	S	5	V	2
TLC5618A	12 bits	2.5-12.5	8.8	S	5	V	2
TLC7225	8 bits	5	75	P	5/15	V	4
TLC7226	8 bits	5	96	P	15	V	4
TLC7524	8 bits	0.1	5	P	5/15	I	1
TLC7528	8 bits	0.1	10	P	5/15	I	2
TLC7628	8 bits	0.1	20	P	11/15	I	2
TLV5604	10 bits	3-9	9	S	3/5	V	4
TLV5613	12 bits	1-3.5	4.2	P	3/5	V	1
TLV5614	12 bits	3-9	9.6	S	3/5	V	4
TLV5616	12 bits	3-9	2.1	S	3/5	V	1
TLV5619	12 bits	1	4.5	P	3/5	V	1

RESOURCES

Literature Requests .... **1-800-477-8924, ext. 9812**
Analog & Mixed-Signal Home Page ...... **www.ti.com/sc/dac**

News Briefs

First intelligent pre-FET driver with dynamic fault threshold

The TPIC44H01, a four-channel, high-side pre-FET driver, is the first device of its kind to provide serial or parallel input interface to control four external NMOS power FETs. It is designed for low frequency switching of resistive or inductive loads including incandescent bulbs and solenoids.

This device is also the first high-side pre-driver with diagnostics compliant with federally mandated OBD II for automotive applications to reduce down time and cost. Each channel has independent open-load detection and over-current and short-to-ground detection/protection with fault status reporting via the serial interface. The TPIC44H01's dynamic over-current threshold is ideal for incandescent bulb applications with long inrush current.

Automotive applications include headlamps, anti-lock brake systems, transmissions and engine controls. Other applications include process control systems, robotics and battery switching/management for PCs. The TPIC44H01 is available in surface-mounted (TSSOP) packaging. ■

➡ **For complete information, order: Data Sheet (SLIS088). See page 8.**

TPIC44H01 features

- Independent fault detection/protection
- Sleep state mode
- Serial interface feedback
- Auto retry mode
- Cascadable serial interface

Cost-effective up-integrated LED driver

TI's TPIC6C595, an 8-bit shift register with 100 mA DMOS outputs, is a low-cost, monolithic IC designed for low-current, medium-voltage loads such as LEDs.

To prevent the outputs from over-current damage, the TPIC6C595 has current-limit capability, which decreases as the junction temperature increases for additional device protection. The outputs also provide snubber circuitry to protect the device from inductive flyback. Each input has transient protection for increased robustness making the device suited for ESD sensitive applications.

The TPIC6C595 offers a cost-effective up-integrated solution plus high reliability for switching LEDs or low-current incandescent bulbs. It is well suited for automotive applications such as instrumentation and heads-up displays and industrial applications such as moving signs and electronic games. The device is available in dual-line (N) and surface-mounted (D) packaging and is characterized for operation over extended temperature range. ■

➡ **For complete information, order: Data Sheet (SLIS061). See page 8.**

TPIC6C595 features

- Outputs current limited, 250 mA, typ.
- ESD protection of 2.5KV
- Low power operation
- Cascadable serial interface
- Operating temp range -40° C to 125° C

Universal asynchronous receiver/transmitter

The TL16C754 is a four-channel universal asynchronous receiver/transmitter UART) that provides serial-to-parallel data conversion from peripherals or modems and parallel-to-serial data conversion on data transmitted by the host. Applications include PCs, fax/modems, telecom equipment or any application requiring an enhanced serial port.

The new device, which is pin-compatible with the 16-byte TL16C554 quad UART, can be placed in an alternate (FIFO mode), relieving the processor of excessive software overhead by buffering received or transmitted characters. In addition, both the receiver and transmitter FIFOs can store up to 64 bytes, including three additional bits of error status per byte for the receiver FIFO. Primary outputs also allow for signaling of direct memory access (DMA) transfers.

The device provides quad-channel integration for reduced board space and cost. The complete status of each channel can be read at any time during functional operation by the processor. It also supports high data throughput of up to 3.2 Mbps (60-MHz input clock) and contains a software interface for modem control operations. The TL16C754 is available in 80-pin TQFP and 68-pin PLCC packages. ■

➡ **For complete information, order: Data Sheet (SLLS279). See page 8.**

How the TL16C754 works
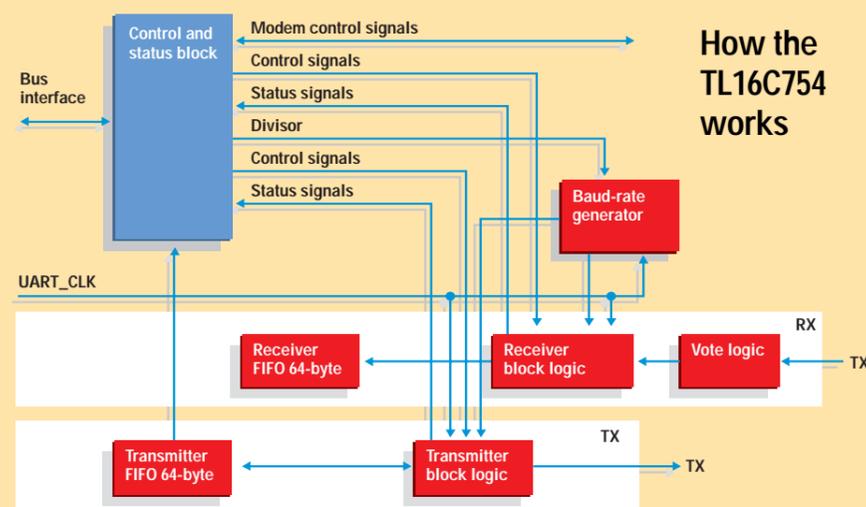
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Resource Guide

APP REPORT

The TMS320C54x accumulators

39-32	31-16	15-0
G	L	H
Guard bits	High-order bits	Low-order bits

The guard bits are used as headmargin for computations allowing some overflow in iterative calculations.

■ **Extended precision IIR filter design on the TMS320C54x DSP:** This application note presents methods of achieving a good compromise in accuracy when carrying out extended-precision multiplications for the implementation of IIR (Infinite Impulse Response) filters. The TMS320C54x devices are 16-bit, fixed-point processors and have several features that help to perform extended-precision computation efficiently. The TMS320C54x CPU has a 17x17-bit hardware multiplier coupled to a 40-bit dedicated adder. The advantage of this multiplier is that it can multiply two unsigned numbers or two signed numbers as well as signed/unsigned numbers [4]. The 'C54x has two accumulators called A and B that can be configured as the destination registers for the multiplier/adder unit. Each accumulator is split into three parts as shown above.

➡ **For complete information, see: www.ti.com/sc/9812.**

WW TECH SUPPORT

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TI Semiconductor Home Page:
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TI Distributors:
www.ti.com/sc/docs/distmenu.htm

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