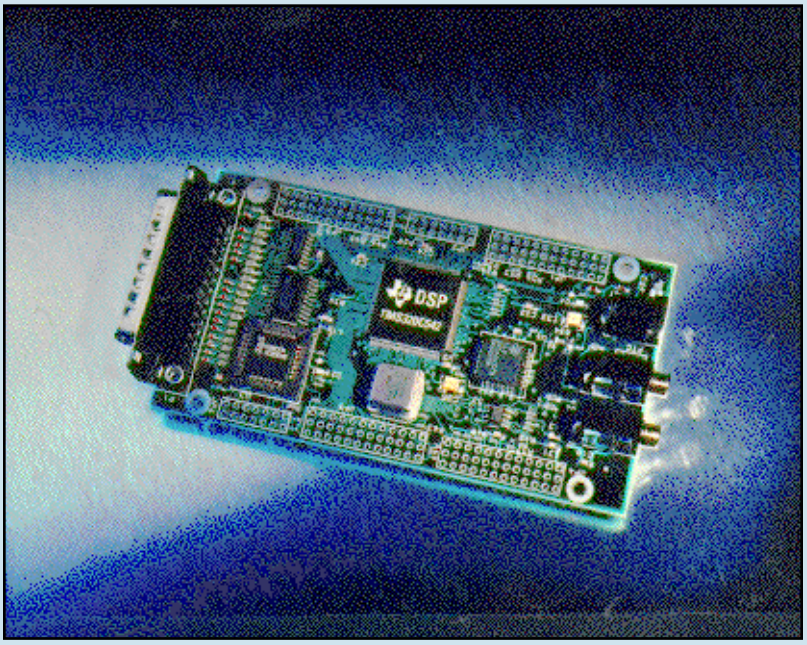
Texas Instruments

Details ON SIGNAL PROCESSING

INSIDE

JANUARY 1997 ISSUE 46



Simplify your high-performance fixed-point designs

New 'C54x DSKplus design tool eases development

The TMS320C54x DSKplus software development tool now makes it easier than ever to begin high-performance fixed-point designs. Featuring the 16-bit, fixed-point TMS320C542 (40 MIPS), the 'C54x DSKplus is the most powerful DSK development tool on the market. The 'C54x DSKplus board also takes advantage of the 'C542's host port interface (HPI), buffered serial port (BSP), and standard serial port for interfacing to a variety of other devices, and extends TI's existing line of DSKs that support the fixed-point 'C2x, 'C5x, and the floating-point 'C3x DSP generations. The high-performance, yet low-cost 'C54x DSKplus (part no. TMDS32000LO) is available for a suggested resale of US $149 through authorized TI distributors.

What makes the TMS320C54x DSKplus an easy-to-use DSK is the true Windows®-based debugger, which provides a visual environment that enables

Continued on page 2

New single-chip DSP Solution for the digital set-top box standards

TI has announced the AV7000 series of DSPs, providing compliance with the worldwide Digital Video Broadcast (DVB) and Digital Satellite System (DSS) standards. This new series is the first to integrate into a single chip the entire DSP Solution needed to decrypt, decode, and display digital video.

The AV7000 series obsoletes an entire generation of set-top architectures that separates the CPU and transport functions from the audio/video decompression and graphics overlay functions. The AV7000 architecture integrates these functions, along with the NTSC/PAL video encoder, to reduce three components to one. This integration is also complemented by the consolidation of multiple memory banks into one 16-Mbit SDRAM.

The TMS320AV7100, the first AV7000 device, integrates the 32-bit ARM® RISC processor, advanced graphics accelerator, transport demultiplexer, conditional access and decryption modules, MPEG-2 video decoder, MPEG audio decoder, and NTSC/PAL video encoder with Macrovision™ copy protection. The 'AV7100 includes an IEEE 1394 digital data port that provides connectivity to a 1394 link layer controller. In addition, the 'AV7100's transport demultiplexer, conditional access, and decryption are optimized for DSS system requirements. A second device, the TMS320AV7110, integrates the same functions as the 'AV7100, but has a DVB-optimized transport demultiplexer and the flexibility to externally support the multiple conditional access and decryption implementations used by

Continued on page 4

'C54x DSKplus eases development

(Continued from page 1)

easier code development and reduces time-to-market. Created by GO DSP Corp., the Code Explorer™ features an algebraic assembler and symbolic debugging in a graphical user interface. The algebraic assembler bypasses learning new DSP mnemonic instruction set specifics and also provides for an easy one-step assembly and linking process. The symbolic debugging enables easy programmability by using labels for referencing constants, variables, and matrices by name.

Other key features include the TI TLC320AC01 Analog Interface Circuit (AIC), which provides low-power dissipation and 14-bit linear resolution. In addition, it increases the board's flexibility with programmability sampling rates and data register read-back capability.

For more information, request the 'C54x DSKplus product bulletin from your regional Literature Response Center (see back cover) or point your browser to www.ti.com/sc/c54xdskplus.

Also available is the 'C54x Computer-Based Training CD-ROM, which contains device information and the 'C54x User's Guide. The CD package also includes a coupon redeemable for a US $50 discount off of the 'C54x DSKplus suggested resale price. See the back cover to request your copy.

The 'C54x DSKplus package contains:

- TMS320C542 DSP (40 MIPS) with 10K words of on-chip dual-access RAM and TLC320AC01 AIC
- Parallel printer port supporting 4-bit/8-bit ports
- Socketed PAL
- Two 3.5" diskettes which include the Code Explorer Windows-based debugger, algebraic assembler, application loader, self-test, and demo software
- Two standard input/output audio jacks
- Parallel printer port cable (25-M to 25-F)
- Universal power supply (5V DC)
- TMS320C54x DSKplus User's Guide
- TMS320C54x CPU and Peripherals Reference Guide
- TMS320C54x Algebraic Instruction Set Reference Guide
- TMS320C54x data sheet
- TLC320AC01 analog interface circuit data sheet
- US $149 coupon toward purchase of the 'C54x evaluation modules (EVM) ■

The 'C54x DSKplus features a high performance, easy-to-use graphical interface.

Take Note ...

- As part of the continuous development of the TI DSP Solutions web site, we've changed our look! Check it out at **www.ti.com/dsps.**
- We've also added TMS320C54x software and hardware development tools to our DSP On-line Lab, in addition to our 'C3x tools. By using the lab, you can compile and link your own "C" code online and run one of two PC-resident hardware debugger evaluation modules. Sign up at www.ti.com/sc/docs/dsps/dsplab.htm.
- The TMS320 DSP Hotline email address has changed. Please use dsph@ti.com should you need direct development assistance. Previous Hotline email addresses will be discontinued shortly.
- Finally, telephone area codes have changed for TI facilities located in Stafford and Dallas, Texas. The new area codes are (972) for TI Dallas connections and (281) for TI Stafford (Houston) connections. See the For More Info box on the back cover for updated listings. ■

TMS320 WORKSHOPS

The Texas Instruments technical training organization offers hands-on workshops designed to help speed designs into production.

To register or for more information, call central registration at (972) 644-5580. Course descriptions can be found on the TI worldwide web site (see back cover).

West Coast, Canada
(Beth Rea) (408) 383-2363
Northeast and Southeast
(Kim Rutherford) (617) 895-9185
Mid-America
(Ron Birkett) (972) 917-3894

TI also provides excellent training support in Europe. For more information, send inquiries to the European customer training fax helpline at +49 8161 804010.

Digital baseband for wireless system design

Industry's first standard-independent, single-chip platform combines 'C54x and ARM cores

TI has released a new single-chip DSP Solution that integrates all the digital baseband functions required for digital wireless telephones and supports using any transmission standard. The standard-independent TI digital baseband platform helps manufacturers reduce the size, weight, component costs, and power consumption in digital cellular phones, digital cordless phones, two-way voice/data pagers, and other types of wireless communications systems.

At the heart of the TI digital baseband platform is a TMS320C54x DSP core, which handles the voice coding, channel coding, error correction, equalization, demodulation, and encryption functions. The 'C54x DSP core features include a Viterbi accelerator, four internal buses and dual-address generators to enable multiple operand operations, a 40-bit adder and two 40-bit accumulators to facilitate parallelism, single-cycle normalization and exponential encoding, and single-cycle instructions including 17-bit unsigned multiplication. In the TSC5000 ASIC backplane, the TMS320C54x core operates at 100 MIPS at 2.5V. The accompanying power dissipation is 0.59 mA/MHz. These features, and others including power-down modes, make the TMS320C54x DSP core well-suited for digital wireless systems.

A 16-bit/32-bit c470 microcontroller core based on the ARM7TDMI (Thumb™) core licensed from Advanced RISC Machines Ltd. (ARM) handles more general system control, such as mobility management and the man-machine interface. The c470 ARM7TDMI microcontroller core can operate in two modes with 75 MHz of performance: 32-bit instructions for faster execution and 16-bit instructions for high code density. The 16-bit capability saves a remarkable amount of memory space and could result in a reduction of the customer's system costs. The 0.25-micron version, operating at 2.5V, is only 2.0 square millimeters on the die (about one-third the size of similar cores) and dissipates only 0.36 mA/MHz.

Because the DSP, microcontroller cores, and the logic gates can be programmed to support any digital wireless standard, the TI digital baseband platform can be used to design systems in any region of the world. In order to accelerate customer time-to-market, TI also has a library of various DSP and MCU software modules, as well as ASIC (application-specific integrated circuit) hardware peripherals that can be licensed to customers to support various worldwide standards.

Both cores are supported by extensive suites of TI development tools and are accessible for in-circuit emulation (ICE) through an IEEE 1149.1/JTAG test port. Special on-chip logic allows simultaneous co-emulation of both cores with a single set of emulation hardware. This unique, proprietary co-emulation capability can save designers months of development time, speeding time-to-market.

The TI digital baseband platform is ready for current engagements from Texas Instruments for use in high-volume digital wireless communications designs. Non-recurring engineering costs and pricing varies based on each customer's specific design configuration.

For more information, request the Wireless Communications brochure and the Digital Baseband technical brief from your regional Literature Response Center (see back cover) or check out www.ti.com/sc/docs/wireless/home.htm. ■

'C5x Teaching Kit helps professors present DSP programming

As part of the TMS320 University Program, TI has introduced the 'C5x Teaching Kit, a package based on the 'C5x DSP Starter Kit (DSK), and designed to aid professors in presenting the basics of TMS320 DSP application development.

Included with the Teaching Kit is ample material for five lectures, each accompanied by a demonstration lab. The five topics covered are:

- an introduction to DSP
- analog-to-digital conversion techniques
- an introduction to filtering
- transformation techniques
- application-oriented development techniques.

"This course provides hands-on experience with DSP tools," said Torrence Robinson, TI's North America University Program Manager. "It allows a student to take a signal through an analog-to-digital conversion, process it with the 'C5x DSK board, and return it to analog form."

The kit includes the DSK (TMS320C5x-based board, assembler/linker, debugger, and documentation), along with a demonstration disk, instructor's guide, student's guide, and a textbook, *A Simple Approach to Digital Signal Processing*, written by TI staff members Craig Marven and Gillian Ewers. The student's guide provides lecture notes, demonstration lab notes, and test sheets that can be duplicated as necessary. Although designed for academic use, the kit is also suitable for training in business settings. The Teaching Kit will be available in March 1997 from authorized TI distributors for a suggested resale price of US $199.

The 'C5x DSK Teaching Kit is part of an expanding TMS320 University Program that includes the US $100,000 TI DSP Solutions Challenge design contest and other projects such as the DSP Talent database, developed with TechOnline, Inc., which provides potential employment opportunities for TMS320-experienced engineering students. Held every August, the annual Educator's Conference offers professors the opportunity to learn about and discuss the latest TI DSP Solutions. For more information on the program, see www.ti.com/sc/docs/dsps/universi.htm or send an email to univ@msg.ti.com. ■

AV7000 for set-top boxes

(Continued from page 1)

different service providers.

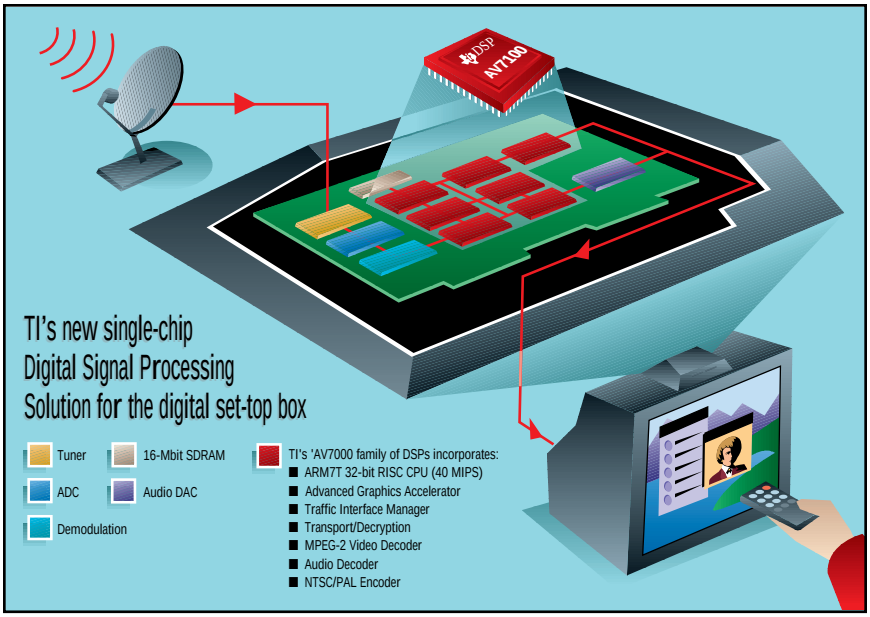
Reduced system cost

The AV7000 architecture satisfies the primary concern of set-top manufacturers: reducing system cost as quickly as possible. The Traffic Interface Manager (TIM) achieves considerable cost reductions by consolidating the memory requirements of each function integrated into the AV7000 into a single 16-Mbit SDRAM. This flexibility to dynamically allocate the system resources to the various functions makes the AV7000 a very cost-effective solution.

Also, the AV7000 employs the ARM7T CPU's 32-bit and Thumb 16-bit instruction sets. With a dual-instruction set, on-chip firmware can execute at the full 32-bit performance, while off-chip software can take advantage of the 16-bit mode to greatly reduce the application software memory size.

Increased processor performance and graphics acceleration

The 40-MHz ARM RISC processor not only supports the TIM and transport demultiplex functions, but also provides over half of its processing power for application software. This processing performance is further enhanced by the addition of advanced graphics acceleration included on-chip.



The graphics accelerator supports multiple graphics windows that support up to 256 colors or true color graphics and can be displayed simultaneously and overlapped, providing a larger viewing area for the video and more intuitive access to information on-screen. Also, the windows can utilize transparency and varying degrees of blending to suit consumer needs.

Support tools

The AV7000 series is supported by an extensive library of graphics functions that facilitate the development of the application software. In addition, compilers, assemblers, linkers and simulators as well as evaluation boards are available from TI to provide the user-friendly environment necessary to rapidly develop and test the application software controlling the user interface.

The TMS320AV7100 is sampling now, and the TMS320AV7110 is planned for sample quantities in February with production for both devices planned for 2Q97. US suggested resale pricing is below $45 in quantities of 100,000 for both devices. For more information, request the AV7000 Product Bulletin from your regional literature response center (see back cover) or see www.ti.com/sc/docs/dsps/products/avxxx/AV7000.htm. ■

New 16-bit AIC provides glueless interface to TMS320 DSPs

TI has announced the TLC320AD56, a 16-bit analog interface circuit (AIC) that provides high-resolution, sigma-delta analog-to-digital and digital-to-analog signal conversion. It also provides a glueless interface, via serial port, to TMS320 DSPs reducing overall system cost and board space.

The TLC320AD56 offers a typical signal/distortion ratio of 103 dB at 3V and 85 dB at 5V on the ADC channel, and 96 dB on the DAC channel. Other features include a programmable serial port interface, power dissipation of 100 mW and 2.5 mW power down (typical), and internal 64× oversampling.

The 'AD56 consists of two serial synchronous conversion paths, one for each data direction, and a pre-DAC interpolation filter and a post-ADC decimation filter. Other overhead functions include on-chip timing and control and a digital loopback function that allows for in-circuit system-level tests.

Key applications for the 'AD56 include V.34+ modems, PCMCIA modems, industrial process controls, as well as other general-purpose AIC functions.

The TLC320AD56 is available in the 28-pin PLCC (plastic lead chip carrier) package and the 48-pin TQFP (thin quad flat pack) package, and will be available in the 28-pin SOIC package. US suggested resale pricing for the 'AD56 is $4.15 in quantities of 1,000.

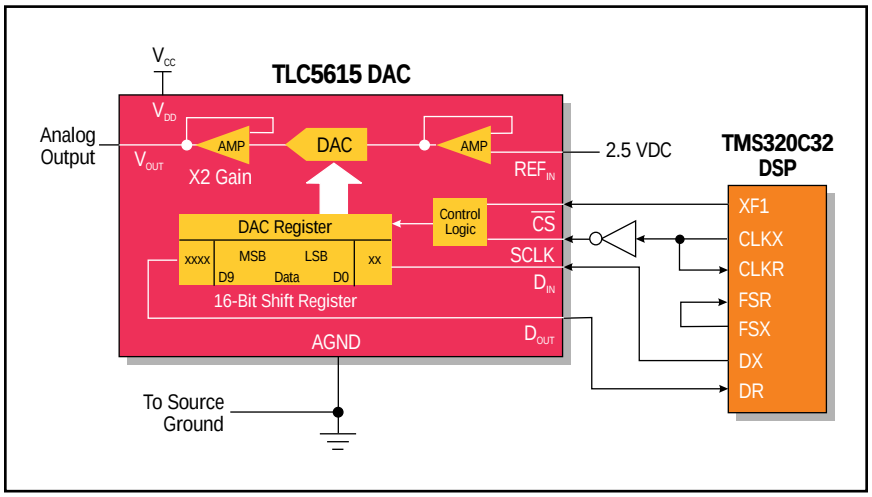
An EVM is available for the 'AD56, which includes an application note on interfacing the 'AD56 to the TMS320C5x DSK. To order the EVM in the US, call (800) 317-8354. In Europe, the 'AD56 EVM (part no. AD56-EVM) is available from TI and authorized distributors.

For more information, request the TLC320AD56 Data Manual from your regional literature response center (see back cover). ■

New 10-bit serial DAC features high-speed and low-power operation

TI has announced the TLC5615, a 10-bit serial digital-to-analog converter (DAC) that provides high performance in a small package, along with a CMOS-compatible three-wire interface for easy interfacing with TMS320 DSPs.

The TLC5615 DAC features an update rate of 1.21 MHz when operating at a clock speed of 20 MHz and a settling time of 12.5 ms (to 0.5 LSB), while consuming only 1.75 mW of power (maximum). It also features single-supply 5-V operation, a high-impedance reference input, a maximum integral nonlinearity (INL) of ±1 LSB, a maximum differential nonlinearity (DNL) of ±0.9 LSB ensuring monotonicity over the temperature range. The output amplifier has a gain of 2, therefore the 16-bit digital control word determines a 10-bit analog output ranging between 0 and a nominal full-scale value of two times the input reference voltage.



The TLC5615 is offered in a small eight-pin, small outline IC (SOIC) package or a regular eight-pin, plastic dual-in-line (PDIP) package, and is available in commercial (0°C to 70°C) and industrial (-40°C to 85°C) temperature ranges.

In addition to the CMOS three-wire interface, an additional digital output enables daisy chaining of multiple TLC5615s or data read-back to the processor (four-wire communication). Supported communications protocols include the SPI, QSPI, and Microwire standards.

Typical applications for the TLC5615 include digital offset and gain adjustment, remote industrial controls, motion-control devices, cellular telephones, and battery powered test instruments.

Suggested resale pricing for the TLC5615 is US $2.90 in quantities of 1,000. For more information on the TLC5615 DAC, request the TLC5615 data sheet from your regional Literature Response Center (see back cover), or see www.ti.com/sc/msp. ■

Video restoration using multiple ’C40s

TI has published a new application report based on the winning entry from the 1995 US $100,000 TI DSP Solutions Challenge design contest. Showbhik Kalra, Dilip Krishnan, and Dr. Chong Man Nang of Nanyang Technological University in Singapore developed a film restoration system which used an array of ’C40 DSPs to restore damaged frames.

Video Restoration on a Multiple TMS320C40 System describes a parallel video restoration system that restores old motion picture archives. A Gaussian Weighted, Bi-directional 3D Auto-Regressive (B3D-AR) algorithm is used to alleviate the presence of noise in the old archives. Common forms of degradation found in such archives are “dirt and sparkle” and scratches. The distortion is caused either by the accumulation of dirt or by the film material being abraded.

While most of the existing image restoration algorithms will blur edges of moving objects in the vicinity of occluded and uncovered image regions, this algorithm is able to suppress mixed noise processes and recover lost signals in both the covered and uncovered regions in an image sequence. This video restoration system is tested on the artificially corrupted image sequences and naturally degraded video (full PAL image size). Samples of the original and corresponding restored image sequence are included in the full report.

The B3D-AR algorithm is parallel implemented on an array of 15 TMS320C40 DSPs connected in a tree configuration. Two different parallel algorithms are implemented in which a close to linear speed-up is achieved by means of a load-balanced parallel algorithm.

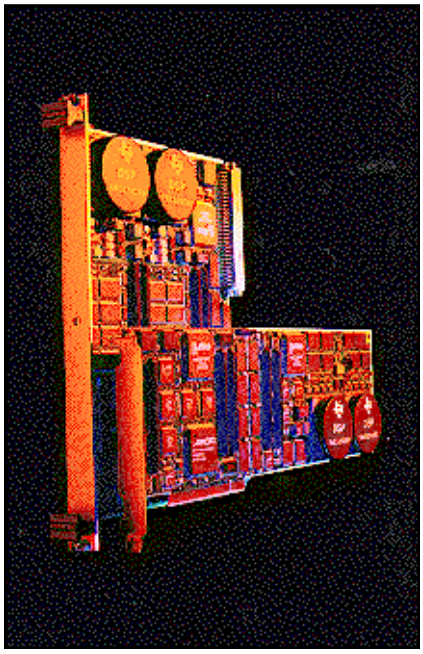
For more information on this application report, see www-s.ti.com/sc/psheets/spra154/spra154.pdf in Adobe Acrobat Format. To view more than 150 online TI semiconductor application reports, www.ti.com/sc/docs/psheets/appnote.htm ■

NEW THIRD-PARTY HARDWARE AND SOFTWARE

This section features new development and application support available through TMS320 Third Parties.

Dual 'C80 boards for PCI and VME™ buses

Pentek has announced two new dual TMS320C80-based image- and signal-processing boards capable of delivering up to 5-BOPS performance in a single VME or PCI slot.



Pentek's 4286 and 7280 'C80-based boards

The 4286 VMEbus® board combines 32 Mbytes of synchronous DRAM, 2 Mbytes of Flash, and support MVPbus I/O daughter board expansion with two 40-, 50-, or 60-MHz 'C80s. Simultaneous access occurs via a $2 \times 4k \times 32$ synchronous BIFO that facilitates 32-bit reads or writes at up to 480 Mbytes/sec. The Model 4286 is planned for availability in 1Q97, and US pricing starts at $8,695.

The 7280 is a DSP accelerator for the PCI bus, featuring up to two 'C80s, and includes 16 Mbytes of synchronous DRAM, twin 2-Mbytes VRAM banks, and 0.5 Mbytes of Flash. The processor cores are coupled via a $2 \times 512 \times 64$ synchronous BIFO, and additional I/O is provided via the expansion interface on the two VRAM banks on each processor. The interface provides support for multiple standards such as RS-170, MTSC, PAL, RGB, and digital camera. The Model 7280 is available now for US $5,295.

Pentek, Inc.
Phone: (201) 818-5900
Fax: (201) 818-5904
email: info@pentek.com

Visual programming software available for Ariel's 'C80 Griffin

Ariel has announced the availability of Logical Vision Ltd.'s WiT software environment for their 'C80-based Griffin image-processing and machine-vision platform. The WiT environment simplifies designs through the selection of functional blocks from the extensive WiT library, which can then be executed continuously, with single-step control, and with breakpoints.

Ariel's Griffin PCI-bus board combines a TMS320C80 with a full 32-bit master/slave PCI bus interface, a 24-bit RGB interface, a 4-Mbyte VRAM frame buffer, and up to 8 Mbytes of DRAM. It also includes a GMI-DCAM digital camera interface, video input and output modules, and an on-board RGB video output based on the TI TVP3025 RAMDAC.

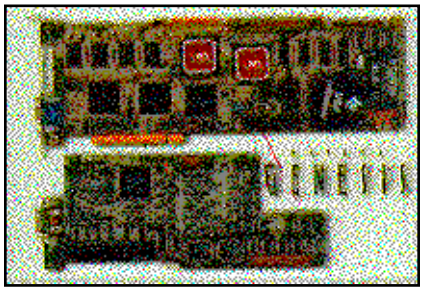
The complete WiT software environment is available from Ariel for US $3,295. The Griffin PCI board starts at US $8,995.

Ariel Corporation
Phone: (609) 860-2900
email: ariel@ariel.com
Web: www.ariel.com

Low-cost imaging subsystem for high-end vision systems

Matrox has released Genesis, a fully-programmable, TMS320C80-based PCI imaging solution for machine-vision, medical-imaging, and image-analysis applications.

The Main Board integrates acquisition, processing, and display all on a single board and scalable processing is achieved by adding up to six processors. The Grab Module captures from virtually any color/monochrome, analog or digital video



Matrox Genesis Main Board and Grab Module feature a TMS320C80

device including $1K \times 1K$, line-scan, triggered, RS-170/CCIR, and RGB cameras, multitap cameras (time multiplexed or parallel streams), and custom-designed devices. Acquisition features include: up to 140-MHz sampling, simultaneous capture/processing of up to four video streams, and up to 32-bit wide, 30-MHz TTL digital acquisition (32-bit RS-422 optional). Also included is a high-level, board-specific C library specifically designed for imaging applications is included.

The Main Board with acquisition, processing, display, 16 MBytes SDRAM, 8 Mbytes WRAM, and native high-level C library is US $8,995.

Matrox
Phone: (800) 804-6243 or
(514) 969-6020
email: imaging.info@matrox.com
Web: www.matrox.com/imaging

TMS320C54x V.34 modem software

GAO Research and Consulting Ltd. has released V.34 software implementations for 'C54x DSPs. The software provides operation for 2,400-bps through 28.8-bps data communications, and features optimized modules in the 'C54x assembly, support for a 200-bps auxiliary channel, adaptive equalization and echo cancellation, trellis encoding, and Viterbi decoding. Requirements for the V.34 (Rx and Tx) are an average MIPS of 23.0, data memory of 5.5K, and program memory of 8.0K. Contact GAO for pricing information.

GAO Research and Consulting Ltd.
Phone: (416) 292-0038
email: gao@io.org
Web: www.io.org/~gao

Telephony codecs now available for 'C54x

ViaDSP has announced the expansion of its *InvisiLink*™ line of telephony codecs to support the TMS320C54x generation of DSPs. The new products will include software and firmware for high-density computer-telephony boards and custom hardware focused on applications such as international call-back, voice over frame relay, and voice over the Internet. Contact ViaDSP for pricing information on the *InvisiLink* codecs.

ViaDSP, Inc.
Phone: (508) 369-0048
Fax: (508) 369-4868

PCI interface card for 'C40 DSP networks

The TDMB414 PCI-to-'C40 host interface card from Transtech Parallel Systems Corp.

Transtech Parallel Systems has announced the TDMB414, a PCI bus card for interfacing TMS320C40 DSPs. By mapping a 'C40 commport to the PCI bus via a 1024-byte FIFO or using the 32 Kbytes of dual-ported memory through the 'C40 global connector, the TDMB414 provides a high performance yet cost effective way of passing data between networks of 'C40s and the PCI bus.

The card also supplies JTAG circuitry, eliminating the requirement for an XDS510, and host OS for DOS, Windows 3.1, and Windows 95. Driver support for 3L Parallel C, Texas Instruments 'C40 C, and SPOX® are available. US pricing starts at $1,695.

Transtech Parallel Systems Corp.
Phone: (800) 836-1012 or
(607) 257-6502
email: transtech@transtech.com
Web: www.transtech.com

'C32-based PCI bus data acquisition board

Innovative Integration has announced the ADC64, a TMS320C32-based PCI bus card featuring up to 64, 16-bit analog input channels, two 16-bit analog output channels, and 16 bits of digital I/O. Also, peak transfer rates of 132 Mbytes/sec allow for real-time data collection and manipulation functions. Eight A/D convertors are muxed to provide 64 single-ended or 32 differential-analog input channels, and two speeds are offered—100 kHz and 263 kHz.

The 'C32 provides the data movement and performs various functions such as conversion according to channel lists, conversion to IEEE floating-point format, data streaming, FFT analysis, trigger selection, and waveform playback. Drivers and DLLs are available for Windows 3.1, Windows 95, and DOS. US pricing starts at $1,195.

Innovative Integration
Phone: (818) 865-6150
Fax: (818) 879-1770
email: techsprt@innovative-dsp.com

Digital filter software for 'C3x development boards

The DigiFilter from MultiDSP is a digital filter design software package that aids in digital filter design and also downloads filter coefficients automatically into 'C3x DSP boards.

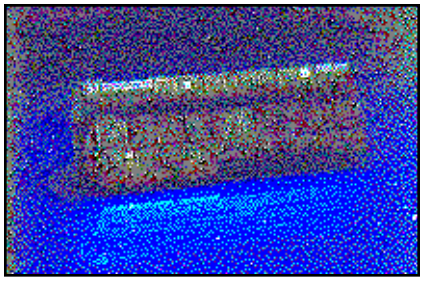
DigiFilter designs FIR (Window and Park-McClellan) and IIR (Bilinear Transformation and Impulse Invariant) filters, and also supports several filter structures with coefficients scaling and allows 8- to 32-bit quantization.

The package supports the TMS320C3x DSK, the DSP Research Tiger 32, and Innovative Integration's PC32. DigiFilter is now available for US $399.

MultiDSP
Phone: (714) 527-8086
email: multidsp@aol
Web: users.aol.com/multidsp/index.html

'C32 computer telephony board

Analogic Corporation has announced the TAP-802, a TMS320C32-based computer telephony, ISA-bus board designed for applications such as remote data access and internet telephony.



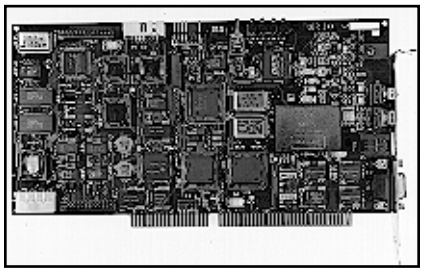
The TAP-802 from Analogic Corp. for 'C32-based computer telephony

The board can accommodate up to 12 'C32 DSPs, allowing the board to run multiple vocoders, and includes 2 Mbytes of shared global DRAM and 256 kBytes of SRAM per processor. The TAP-802 is available for US $6,995.

Analogic Corporation
Phone: (508) 977-3000
Fax: (508) 977-6813
email: tshugart@analogic.com

'C203 PC development board

DSP Research has released the TIGER 203/PC, a development board based on the TMS320C203, and featuring up to 256 kBytes of SRAM, two 16-bit, 50-kHz I/O channels, and stereo input and output jacks. For fax and modem applications, the 203/PC has a standard RJ-11 telephone interface and an RS-232 UART.



DSP Research's TIGER 203/PC development board

Also included is the TIGER QuickSTART Operating Environment, which provides device drivers, DSP memory allocation, buffer handling, and standard I/O to the host computer. Pricing starts at US $1,695.

DSP Research
Phone: (408) 773-1042
email: info@dspr.com
Web: www.dspr.com ■