pulse

INNOVATIONS & INNOVATORS

Fanless CPUs tackle extremes

Parvus recently introduced three ruggedized, 800-MHz Pentium-based embedded-processor boards for demanding mobile, high-vibration, and extreme-temperature computing applications. The PC/104-Plus-form-factor CPU cards each incorporate an Intel ULV (ultralow-voltage) Tualatin Pentium III processor, an Intel 815E chip set, and select peripherals. The devices include the SpacePC CPU-1460, which includes standard embedded-PC-peripheral devices; the SpacePC CPU-1461, which supports as many as eight USB devices, six of which comply with high-speed USB 2.0; and the SpacePC CPU-1463, which features dual network controllers, including a Gigabit Ethernet interface and a 10/100-MHz Ethernet controller.

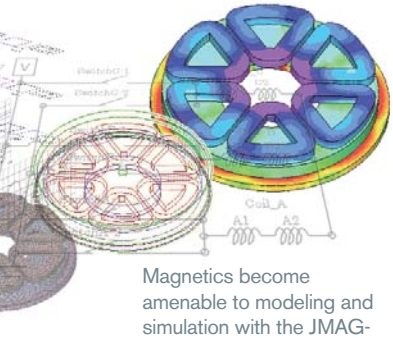
Each module employs a flat, aluminum heat-spreader plate on top of the processor boards so that sealed embedded systems can reliably operate at −40 to +85°C without a fan. The modules are also hardware-compatible with most popular real-time operating systems, including Windows CE, Windows XP Embedded, Linux, QNX Neutrino, and VxWorks. The CPU-146X models are available now for $1023 to $1253 (100).

Three new ruggedized PC/104-Plus CPU boards from Parvus integrate the low-power Intel Pentium III processor with multiple peripheral options.

—by Warren Webb

▷**Parvus Corp**, www.parvus.com.

Field-analysis software is the EDA of magnetic designs



Magnetics become amenable to modeling and simulation with the JMAG-Studio tool from Japan Radio, available in the United States from Motorsoft.

Software-design tools are not just for IC and pc boards; designers of motors, inductors, generators, and solenoids also benefit from the assistance of the advanced modeling, design, and simulation tools. JMAG-Studio from the Japan Radio Institute (www.njr.co.jp) is now available in the United States through the Motorsoft Division of Fisher Electric Technology. It provides magnetic-field analysis for 2- and 3-D, static and transient problems. The program's models yield magnetic flux, flux density, EM force, torque, stored energy, current density, loss, impedance, inductance, voltage, and other parameters.

Designers can use the well-known Solidworks (www.solidworks.com) CAD package as the source of the input data for the 3-D analysis. The automatic mesh function provides the optimal mesh for the magnetic analysis. The 2- and 3-D standard packages sell for $16,000 and $18,400, respectively.**—by Bill Schweber**

▷**Motorsoft/Fisher Electric Technology**, www.motorsoft.com.

MAGNETIC ENCODER OFFERS EXTREME NONCONTACT RESOLUTION

Using a technology similar to a magnetic tape or disk platter, the Siko Products MSK5000 linear/rotary encoder is a 5-mm-wide band with programmable resolution to 1 micron (0.001 mm). In contrast to optical systems, this approach resists dirt and contamination, accepts larger misalignment tolerances, and has a wider temperature range. The flexible, adhesive-backed band is straightforward to install, and the integrated translation-unit read head includes status LEDs and setup indicators. Read distance, or ride-height run-out, can be as much as 2 mm. The price for a linear or a radial encoder tape and read head starts at approximately $200.

—by Bill Schweber

▷**Siko Products Inc**, www.sikoproducts.com.

For precise linear and rotary sensing, the magnetic-based MSK5000 offers resolution to 0.001 mm and a read distance as long as 2 mm. It remains unaffected by dirt, which can impede optical-sensing approaches.

ICs enable analog video to give and receive

Despite the digital nature of many video signals, they often need to live in the analog RGB/YPbPr world, alongside the line drivers and receivers that make that world possible. The ISL59830 IC from Intersil facilitates this collaboration. The single-supply, triple-video driver internally generates its requisite negative supply, thus eliminating the need for a negative-supply rail and dc-blocking capacitors.

Pay attention, you digital-system designers: In the arcane world of video architectures, circuits use either ac or dc interstage coupling. The ac approach needs relatively large external capacitors but no negative supply; the dc approach requires a bipolar supply but no capacitors. According to Sameer Vuyyuru, director for high-speed analog at the company, "The video driver is often the only product in a design that still requires a negative-supply rail where dc accuracy is required."

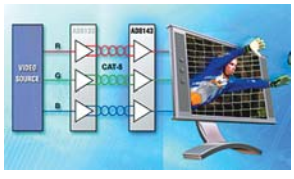
The 3.3V IC has built-in fixed-gain-of-two (6-dB) buffers and three-state outputs, designed to drive 75Ω, double-terminated lines. Bandwidth is 50 MHz at 0.1-dB flatness and 300 MHz at 3 dB for the 16-lead devices, which are available for $1.88 each (1000).

Line driving alone is only part of the video-signal chain. Analog Devices' AD8143 triple differential receiver lets designers use Category 5 unshielded twisted-pair cable rather than more expensive coaxial cabling for RGB signals with resolution as high as 1600×1200 pixels. Designers can also use the IC for general differential-analog or high-speed data signals. The IC converts differential signals to single-ended signals with a common-mode range of ±10V to maintain signal integrity despite large ground-potential difference. CMRR (common-mode-rejection ratio) is 70 dB at 10 MHz.

In addition to the line receivers, the device contains two comparators, which can sense digital signals from the unused fourth pair in the cable. A typical use would be to handle keyboard and mouse signals in KVM (keyboard/video/mouse) applications. The AD8143, a 5×5-mm, 32-lead device, sells for $2.55 (1000) and is the complement to the AD8133 triple-differential line driver.—**by Bill Schweber**

▷**Intersil Corp**, www.intersil.com.

▷**Analog Devices Inc**, www.analog.com.



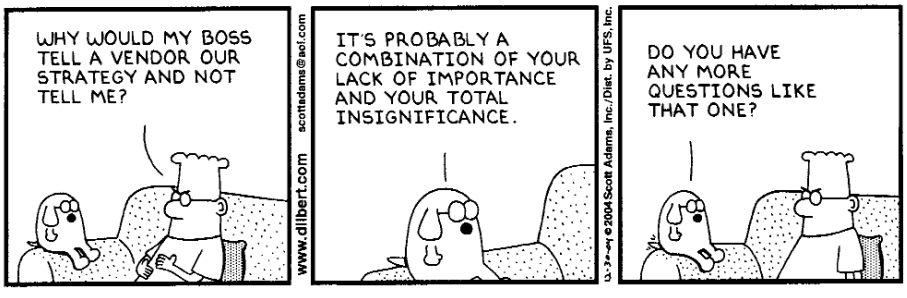
The latest ICs ease the task of analog-video-line driving and receiving: The Intersil ISL59830 triple driver requires no negative supply or blocking capacitors (left), and the Analog Devices AD8143 triple receiver lets systems operate with Category 5 twisted-pair cabling rather than more expensive cables (right).

FEEDBACK LOOP

"I do feel badly for the brighter high school students to whom electrical engineering might have offered a solid technical future."

Rudy Dankwort, in *EDN*'s Feedback Loop on www.edn.com/article/CA526328. Add your comments.

DILBERT *By Scott Adams*



$30 module embeds speech recognition

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Sensory recently unveiled the VR Stamp module, which provides easy integration of voice recognition into consumer, industrial, automotive, and medical electronics. Sensory based the module on the company's RSC-4128 mixed-signal processor, which includes an 8-bit microcontroller, an ADC, a DAC, digital filtering, RAM, ROM, and output amplification. The device also packs flash memory, serial EEPROM, clock crystals, and noise-management components into its standard, 40-pin DIP footprint.

Sensory's FluentChip software provides speech recognition, speaker verification, speech compression and output, music synthesis, and diagnostic and utility programs. Bill Teasley, Sensory's vice president of engineering, says, "The VR Stamp makes it practical for developers to incorporate voice recognition and speech synthesis as the human interface to any product. Imagination is the only limitation." The VR Stamp modules sell for less than $30 (high volumes). Sensory also offers a $495 VR Stamp tool kit and programming board to simplify the development of speech command sets, speech-synthesis prompts, and end-product circuit design.—by Warren Webb

▶**Sensory Inc**, www.sensoryinc.com.

Embedded computer packs extra I/O

Micro/sys based its new SBC0489 single-board computer on the STPC Atlas PC-compatible processor. The device delivers an I/O-rich single-board computer in a 5×5-in. footprint. Along with expected PC features, such as SVGA and disk controllers, the board also includes digital I/O, ADCs, DACs, and Ethernet support. With 64 Mbytes of RAM and as much as 128 Mbytes of flash, SBC0489-based systems can run applications requiring headless and diskless configurations as well as full disk-based GUI systems.

The SBC0489 includes COM1, COM2, LPT1, keyboard, mouse, floppy, IDE, and 8×8-key matrix touchscreen or keypad interfaces. A Super-VGA interface drives CRT monitors and active-matrix flat-panel displays with resolutions as high as 1024×1024 pixels. Application I/O includes 10/100-MHz Ethernet; 24 CMOS I/O lines from an 82C55; an eight-channel, 12-bit ADC; a four-channel, 12-bit DAC; and three 16-bit timers from an 82C54. Designers can add I/O expansion if necessary to the SBC0489 through both PC/104 and PC/104-Plus cards.

The SBC0489 can boot DOS, Linux, Windows CE, and other PC-compatible operating systems. The company ships a free development kit, which includes cables, sample software, and full documentation, with the board. Prices for the basic SBC0489 start at $595 (one).

—by Warren Webb

▷**Micro/sys Inc**, www.embeddedsys.com.

The SBC0489 single-board computer mates a PC-compatible processor with analog I/O, digital I/O, and 10/100-MHz Ethernet interfaces.

MOTOR CONTROLLERS EASE DO-IT-YOURSELF CHALLENGE

Having a good motor is one thing; controlling the motor properly is another. The $850 Silverdust IGB from Quicksilver Controls provides servo control for NEMA 17 and 23 frame-sized microstep motors with encoders. Using this controller, you can achieve the performance of a four-quadrant servomotor but with a lower cost, two-phase motor. In addition, you can program the unit for advanced profiles, PID and velocity servo modes, and other motion-specific operations. It includes connections for power and communications, plus 16 isolated, 5 to 24V-dc, bidirectional I/O lines and four analog inputs.

For network-based, multiaxis motion supervision, the Maestro servoamplifier from Elmo Motion Control provides synchronized control, interpolated 2- and 3-D control, sequencing, and event handling, all as a CANopen Master. It operates as an Ethernet-to-CAN (controller-area-network) gateway with connectivity to a host PC or machine-control programmable-logic controller, with monitoring through a Web browser. Available software tools, which come with the unit, support application development and network installation. The basic unit sells for $1400.—by Bill Schweber

▶Quicksilver Controls Inc, www.quicksilvercontrols.com.

▶Elmo Motion Control Inc, www.elmomc.com.

It's all about control. Motor controllers from Quicksilver Controls (left) and Elmo Motion Control (right) provide supervision and implement motion-control strategies that optimize performance and minimize errors.

FEEDBACK LOOP

"I'm glad someone finally understands the outsourcing issue and the long-term impact to our economy. Our high-tech bigwigs are mortgaging our country's future, and they don't seem to care. They are like a bunch of lemmings—everyone else is doing it, so we have to do it. This is what happens when you let business people run high-tech companies.

Warren Peluso, in *EDN*'s Feedback Loop at www.edn.com/article/CA601510. Add your comments.

Tools support hot-swap and rewind debugging

The Platinum Edition of Texas Instruments' CCStudio (Code Composer Studio) integrated development environment introduces target-board hot-swap and a debugging-rewind feature that can help developers save time when tracking down system bugs. The new connect/disconnect feature allows developers to avoid a reset-and-reload sequence with the CCStudio tool set when hot-swapping target boards during a debugging session. This feature is useful when developers are simultaneously debugging hardware and software. A developer can replace a suspicious board with a known good board during the debugging session and eliminate the suspicious hardware or software as the source of potential errors. The connect/disconnect feature can save minutes between each reset-and-restart sequence.

The CCStudio Platinum Edition also introduces a rewind feature that allows developers to move both forward and backward within their source code during simulation. This feature allows developers to use a back-step keystroke and avoid reloading and stepping through a program from the beginning to find code errors. The rewind feature maintains a history of execution that normal step-and-run commands make so that a developer can view the program state and run code from earlier points in the program. The feature has no associated overhead, so it doesn't slow down the simulation as it records execution of the application.

Other enhancements to the CCStudio Platinum Edition include support for the CodeWright Editor; tuning tools and compiler upgrades that support all of the TI platforms; and a component manager that enables developers to manage upgrading and locking versions of the IDE components, including compiler and DSP/BIOS software-kernel versions. The CCStudio Platinum Edition now supports development for multiple TI platforms within a single tool installation, and the price for supporting all of the TI platforms is the same as the cost to support a single platform in earlier versions of CCStudio. The CCStudio Plat-inum Edition IDE is available now for $3600; includes 15 months of update-subscription service; and supports all TI platforms, including the TMS320C6000 DSP, TMS320C5000 DSP, TMS320C2000 DSP, and OMAP (Open Multimedia Applications Platform). There is also a free 120-day evaluation version available on CD-ROM.**—by Robert Cravotta**

▷**Texas Instruments**, www.ti.com/ccstudioplatinumpr.

Brushed, brushless motors serve tailored applications

Considerable segmentation exists in IC taxonomy, and it's easy to think that the motor world is less fragmented, but that idea is a misconception. Among the major motor categories are brushless units, and a new series of axial air-gap units from Applimotion features low weight, zero cogging, and a low-profile package. Applications include microliter metering in precision instrumentation, scanning equipment, and inspection systems. The motors feature diameters as large as 300 mm and axial thickness of 5 mm. The units operate from 5 to 48V supplies with standard three-phase brushless controllers. The frameless construction lets engineers slip these units into designs that currently lack internal motors. Prices range from $250 to $750, depending on size.

Voice-coil motors offer linear motion over a modest distance but at high speed. Members of the VM-series from Gee Plus produce peak forces from 12N (2.7 lbs) to 150N (31.5 lbs) for the VM8054. That largest unit has a 3.15-in. outside diameter and is 2.13 in. long. The overall stroke is 1.26 in. at 10% duty cycle and with a 500W input. The smallest member, the VM4632, has a 0.4-in. stroke, a 210W input, and a 10% duty cycle; it sells for $208.

For applications requiring miniaturization—a major factor in today's squeezed systems—the HG16 series of integrated, brushed dc motors from Nidec Copal may fill the bill. Each device includes a gear train, and an encoder measures 16 mm in diameter and 62.4 mm long. Targeting use in medical-lab equipment; small-camera pan, zoom, and tilt units; and compact printers, the series includes a dozen models with operating voltages of 6, 12, and 24V and gear ratios of 30-, 60-, 120-, and 240-to-1. Rated torque is 3.47 oz-in. for the 30-to-1 unit to 6.94 oz-in. for the 240-to-1 version. No-load speeds are 60 to 390 rpm, depending on gear ratio. Prices begin at $27 (100).

—by Bill Schweber

▷**Applimotion Inc**, www.applimotion.com.

▷**Gee Plus Inc**, www.geeplus.biz.

▷**Nidec Copal USA Corp**, www.copal-usa.com.

Take your motion, brushed or not, with a flat, axial air-gap unit from Applimotion (left), a voice-coil unit from Gee Plus (center), or an integrated dc motor with a gear train and an encoder in a narrow total package from Nidec Copal (right).

GLOBAL DESIGNER

ARM boosts support to Indian design shops

With ARM microprocessor cores becoming increasingly popular with Indian design houses, the Indian subsidiary of the company is stepping up its involvement in the local market. "We work directly with 50 companies, and the number is poised to grow with the introduction of technologies and tools. Nearly 2000 engineers in Bangalore and about 5000 across the country work with ARM architecture," says Atul Arora, president of the Commercial Operations-India Division of ARM Embedded Technologies Ltd.

Developers are designing ARM chips into home-electronics products, such as digital TVs and set-top boxes; mobile devices, including phones and PDAs; enterprise applications, including data-storage units, printers, and wireless LANs; and embedded systems for automotive, medical, and industrial applications. "ARM is looking to increase its partnership with Indian companies, and the ADC (ARM-Approved Design Center) program is another way to work with the local market," says Arora. ARM has four such centers in India, and a total of 11 in the Asia Pacific.

Wipro (www.wipro.com) has been working with ARM technology since 1997 and became an ADC member in 1999. Today, Wipro has a team of more than 250 ARM experts and has developed more than 50 ARM-based systems on chips, covering ARM7, 9, and 11 series using both third-party- and in-house-developed platforms. "The ADC agreement provides Wipro with early access to the entire ARM environment, enabling us to provide first-time-right designs," says A Vasudevan, vice president of the VLSI Group of Wipro Technologies.

A more recent inductee into the ADC program is MindTree Consulting (www.mindtree.com). The company has for more than three years been involved in ARM-based designs for a number of international customers. "To support our product-realization services, we decided to combine our domain knowledge and design expertise with ARM processors to expand our offerings to customers," comments SN Padmanabhan, vice president of R&D services at the company. The company is working on multiple ASSP (application-specific-standard-product) designs for customers.

–by Chitra Giridhar, *EDN Asia*

▷**ARM**, www.arm.com.

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Asian SOPC-design applications now textbook cases

A low-cost DVB (digital-video-broadcasting) code-stream-monitoring system, an affordable articulation-type robot for industrial applications, and a real-time-face-recognition biometric system won first prizes at the recent Altera Nios Soft-Core Embedded Processor Design Contest among university-level design teams from China, Taiwan, and India. The contest has helped thousands of young Asian engineers to gain hands-on SOPC (system-on-programmable-chip)-design expertise. The company launched the contest in late 2004 and completed it in March 2005. More than 200 design teams from major Asian universities participated.

The *Nios Soft-Core Embedded Design Contest* book includes design entries from finalists in the contest.

Altera has now collected all the finalist entries to the contest and published them in *Nios Soft-Core Embedded Design Contest* (Xidian University Press, ISBN 7-5606-1496-5/TN.0297, www.xidian.edu.cn). The book details a common theme through the finalists' designs: the ability to extract the best from Altera's FPGA flexibility and the customizable instructions of the Nios processor. China's winning entry, the DVB-code-stream-monitoring system by Xidian University (Shaanxi, China), uses Cypress Semiconductor's (www.cypress.com) CY7B923 to process DVB-ASI (asynchronous-serial-interface) signals. Then, using Altera's FPGA and Nios processor, the Chinese team designed a low-cost, compact DVB-code-stream monitor.

The face-recognition-biometric-design winning entry from the Indian Institute of Technology (Madras, India) implemented the entire design with Altera's SOPC and its custom-instruction feature using the Nios processor. The Taiwanese winning entry, an articulation-type robot from Southern Taiwan University of Technology, implemented a mechanical-arm servo-control system that the team based on Altera's FPGA and Nios processor.

The Nios Design Contest 2004 was a success because of the diversity of creative applications from the entrants, according to Paul Chan, product manager for Altera's Asia-Pacific region. "We have seen Nios in applications such as robots, GPS (global positioning systems), MP3 players, DVB-S baseband processing systems, and fingerprint scanners," he says. Chan says the design contest has helped to create an awareness of the use of soft-processor and FPGA among budding designers. Judging the winning designs was difficult. Altera appointed a panel of engineering experts to judge them according to parameters such as technical difficulty, efficiency of coding, creativity, quality of hardware implementation, and practical significance.

The contest has wider implications because, says Chan, "Asian engineers' logic-design and embedded-processor-design skills are high-quality. As Asian companies expand into the global market, creativity and innovation will be crucial in developing a sustainable competitive advantage, and the results of the Nios-design contest show a positive signal of this trend."**–by NS Manjunath, *EDN Asia***

▶**Altera**, www.altera.com.

The thermoelectric-cooler device includes a cooling fan, heat sink, six thermocouples, and heat-sink compound to carefully control glass-surface temperature.

RESEARCH UPDATE

BY BILL SCHWEBER

Noninvasive technique measures humidity in sealed glass case

The National Aeronautics and Space Administration's Langley Research Center has designed a technique for continuously measuring the humidity within the glass cases holding the original US Declaration of Independence, Constitution, and Bill of Rights. The noninvasive approach provides real-time assessment using the well-established chilled-mirror-hygrometer method of observing the formation of condensed water droplets inside the glass. However, this technique adds extra attention to detail and established calibration factors to correct for errors and offsets when determining the precise dew point.

An aluminum-plate heat sink attaches to the glass, and a thermoelectric module and integral fan cool the plate. An array of six thermocouples within the plate measures the temperature of the cooled outer surface of the glass panel; heat-sink compound between the thermocouples and the glass ensures low thermal impedance. As the thermoelectric module's output temperature ratchets down in small increments, an observer looks at the glass with a flashlight and magnifying glass for condensation to form the first water droplets on the glass's inner surface. Researchers then apply adjustment algorithms, along with data sets they collected in equivalent lab setups, to determine the internal humidity and dew-point values.

You can find a summary of the research at the June 2005 issue of www.techbriefs.com and a full report at http://techreports.larc.nasa.gov/ltrs/PDF/2004/mtg/NASA-2004-ncsl-cgb.pdf.

▷**National Aeronautics and Space Administration**, www.nasa.gov.

Mobile-phone fuel cell triples capacity

Fujitsu Laboratories in conjunction with NTT DoCoMo (www.nttdocomo.com) has shown a prototype of a micro-sized fuel cell with 18-cc capacity and an external charger that uses methanol at 99% concentration, far higher than the 30% conventional concentration. In passive-cell designs, the higher methanol concentration soon overwhelms and stops the cell operation due to a saturation-and-permeation phenomenon, even though it offers more potential capacity. Fujitsu used a new membrane material, which significantly reduces this methanol-crossover effect.

The prototype cell weighs 190g and measures 150×56×9 mm. Its maximum power-generation rating is 9W, and it can charge a trio of lithium-ion cells at 5.4V/700 mA.

▷**Fujitsu Laboratories**, www.labs.fujitsu.com.

PHOTONIC RADIO GETS CLOSER

The DARPA (Defense Advanced Research Projects Agency) has awarded a contract to Phasebridge Inc to further the development of an optical RF QPSK (quadrature-phase-shift-keying)-modulation technique for use in ultrawideband, frequency-agile, military-radio systems. The project's goal is to integrate frequency-synthesis and conversion methods for microwave through millimeter-wave channel frequencies. This objective requires electro-optical conversion, using integrated optics and micro-optical lenses, which are low-cost, lightweight, and precisely aligned with minimal production trim.

▶**Phasebridge**, www.phasebridge.com.

Serious superconducting motor gets real

A 5-MW motor using HTS (high-temperature-superconducting) wire and magnets has passed load- and ship-mission-testing protocols. American Superconductor designed the motor under an Office of Naval Research contract as an interim step toward a 36-MW, 49,000-hp, 120-rpm unit under development for ship propulsion. The goal is a propulsion system that has one-third the weight and one-half the size of conventional copper-based motors of the same rating.

The 5-MW motor underwent static and dynamic tests at the Center for Advanced Power Systems at Florida State University (Tallahassee). Alstom Power Conversion's (www.powerconv.alstom.com) Rugby, UK, facility designed, built, and conducted further tests on the stator- and marine-drive electronics. In the static tests, the motor ran at full load and speed, 230 rpm, for 21 hours; resultant temperature and performance data agreed with design predictions. In the dynamic test, the test station imposed load variations of 0.5 to 10% around moderate- and full-power operating points. Testing also used hardware-in-the-loop simulation to control the motor and emulate complete propulsion-system operation.

▶**American Superconductor, www.amsuper.com.**

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