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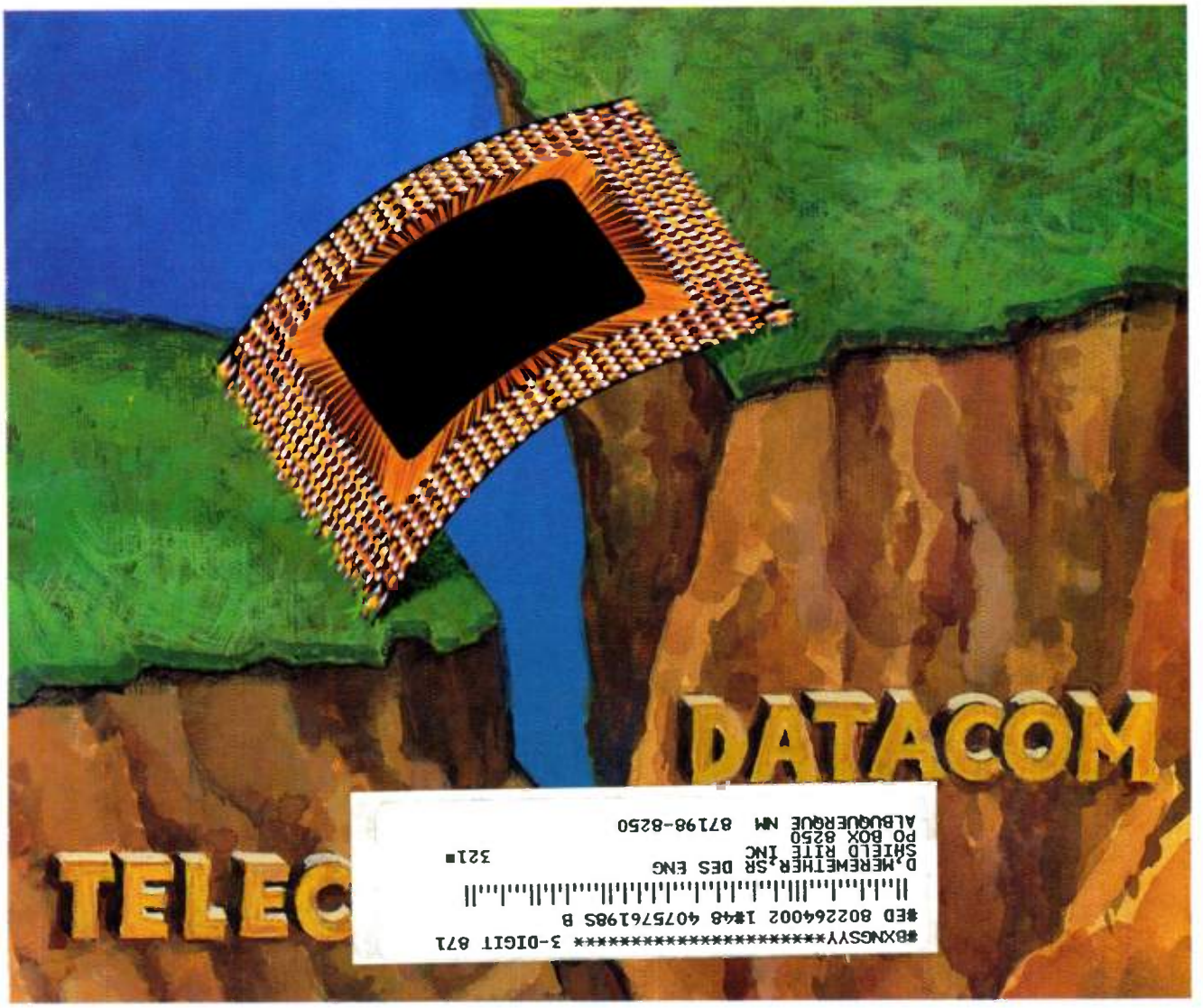

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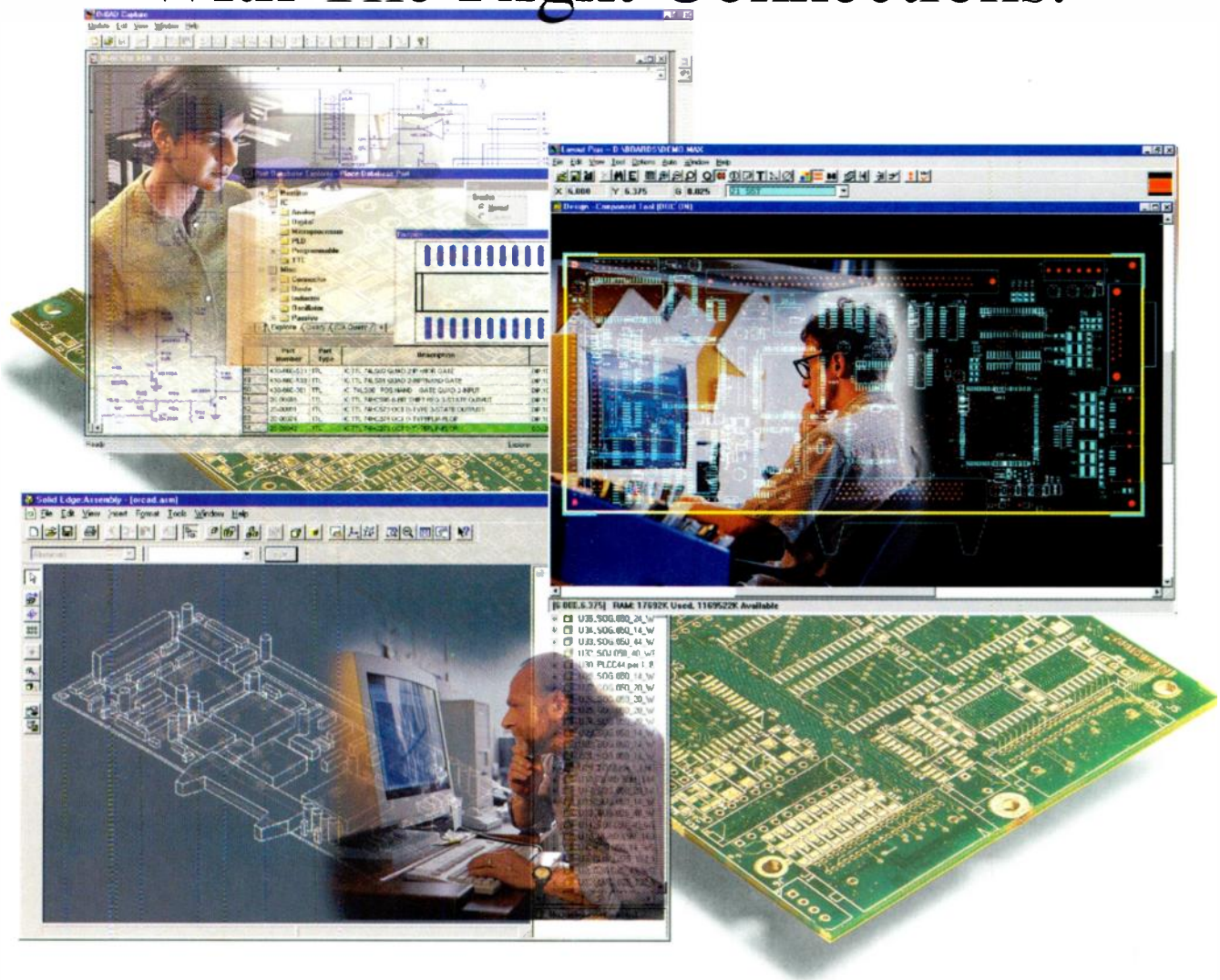

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Applications 101: Power Amplifiers

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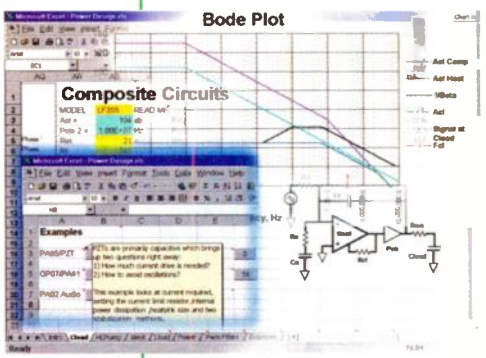
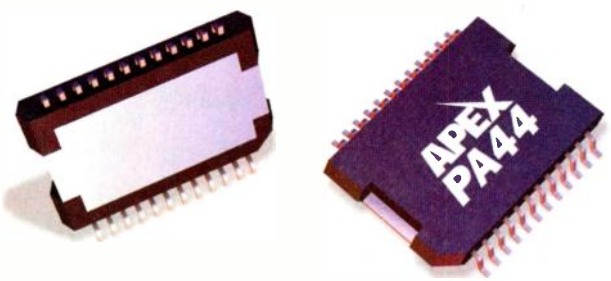


New Computer Aided Design Tool Automates Designing With High Voltage Amplifiers

PA44

New Surface Mount 350V, 120mA Monolithic Power Op Amp



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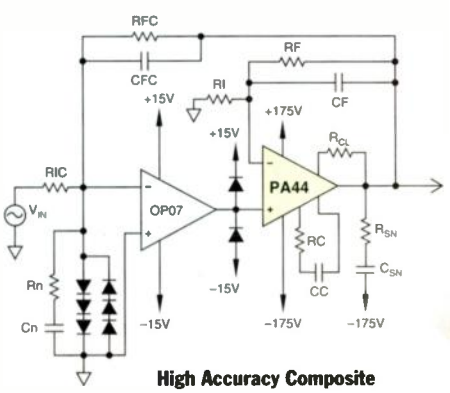

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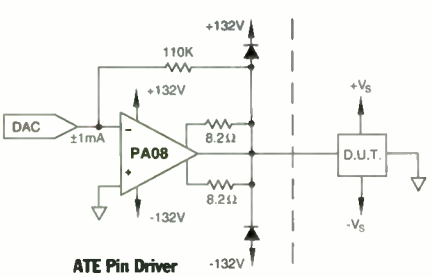
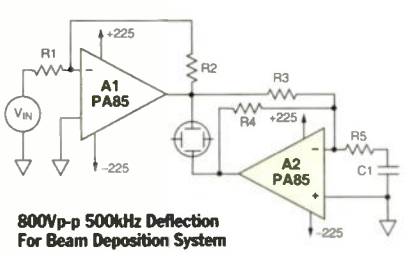


ATE Pin Driver



800Vp-p 500kHz Deflection For Beam Deposition System

New Computer Aided Power Design Tool

Apex's new computer aided Power Design Tool is a self-documented spreadsheet that automates the tedious calculations associated with:

- stability analysis
- internal power dissipation
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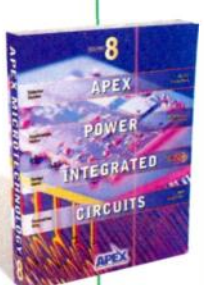
- PWM filter design

This spreadsheet also includes examples which can be used as tutorials on power op amp design. This design tool is **free** and can be downloaded from the Apex web site at www.apexmicrotech.com. Upon execution it is suitable for Excel 5.0 through Excel 97.



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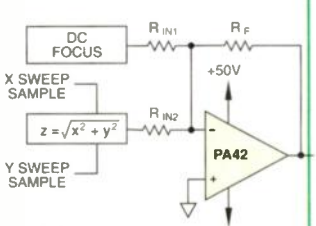
PA42	100V-350V	120mA	2mA	40V/µs	SIP
PA44	100V-350V	120mA	2mA	40V/µs	PSOP
PA85	30V-450V	350mA	25mA	1000V/µs	TO-3
PA88	30V-450V	200mA	2mA	30V/µs	TO-3
PA89	150V-1200V	100mA	6mA	16V/µs	PowerDip



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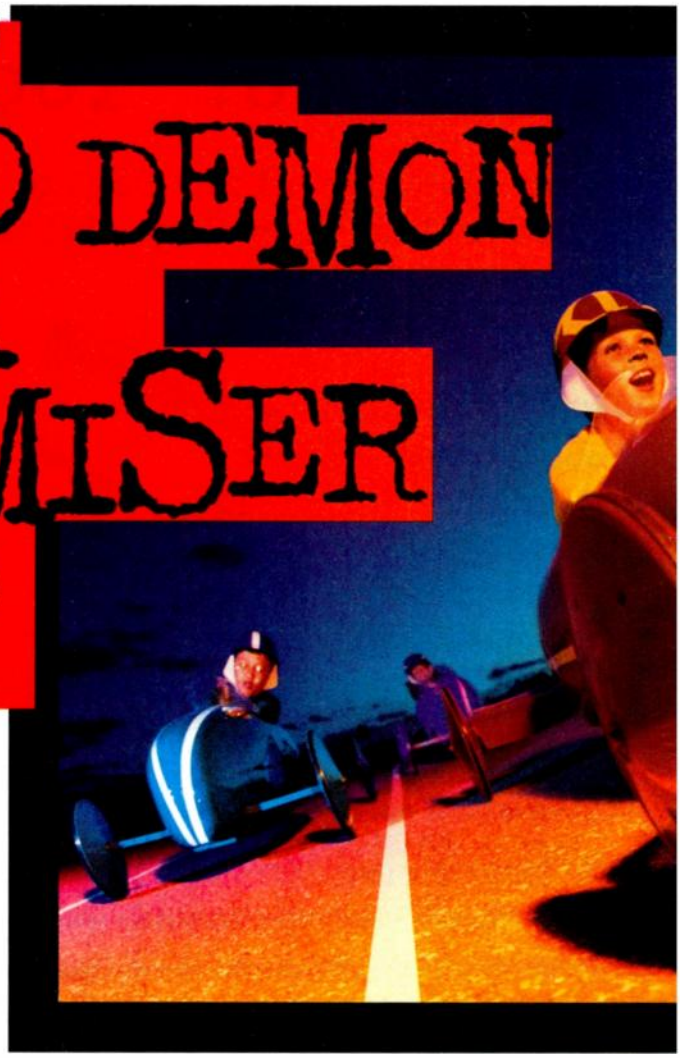
What's it going to take

TO PUT A SPEED DEMON IN A POWER MISER CHIP?



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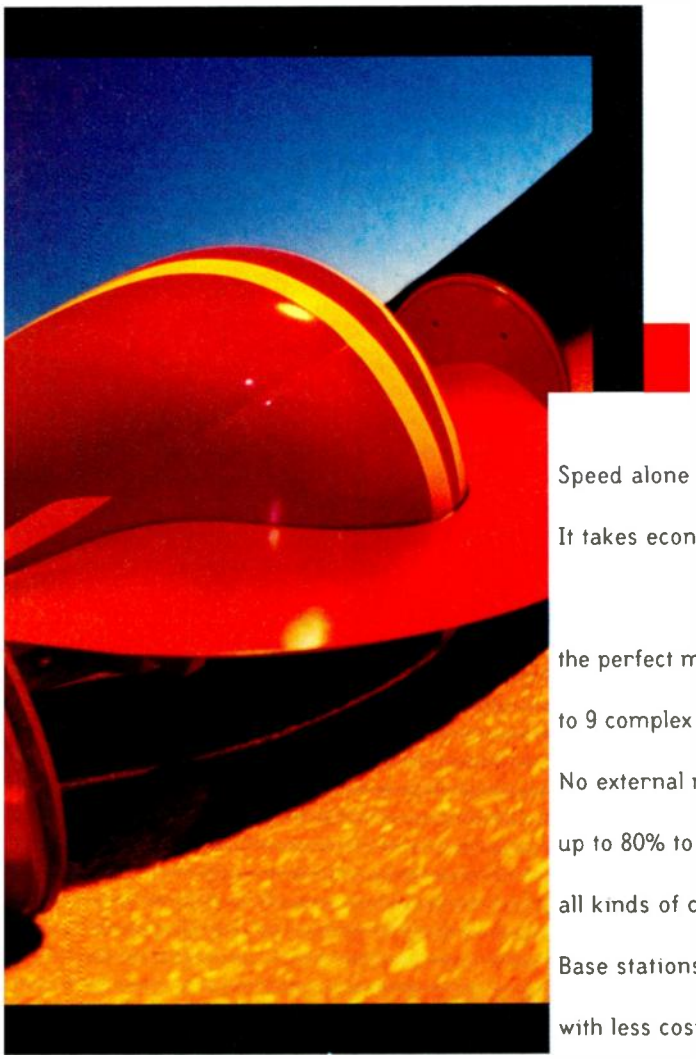

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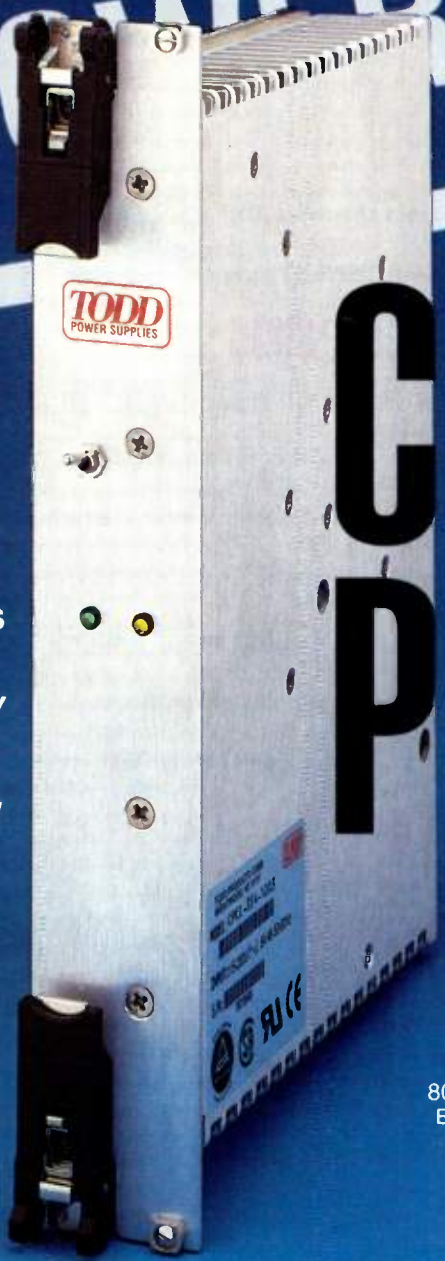

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• *It slices, it dices, it makes lovely julienne ATM packets... handling ATM, Ethernet, and TDM traffic, this dual-CPU, multi-PHY communication processor does it all—and does it well.*

48 System-Class CPLDs Zip Along At Flank Speeds Of 110 MHz

• *The high-density ispLSI family's arsenal packs 840 macrocells, delivers up to 43,750 PLD gates, and sports 312 I/O pins.*

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• *Its heritage and infrastructure are unmatched, and new schemes such as VME320 and vPCI are paving the path to the future.*

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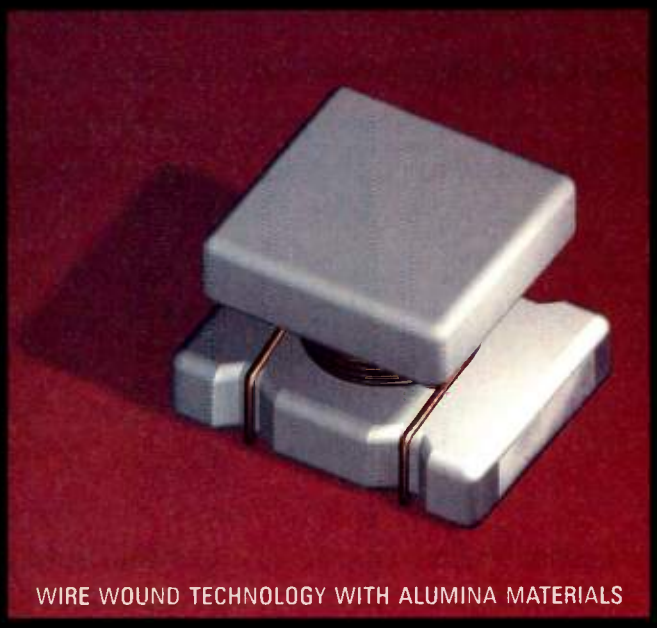

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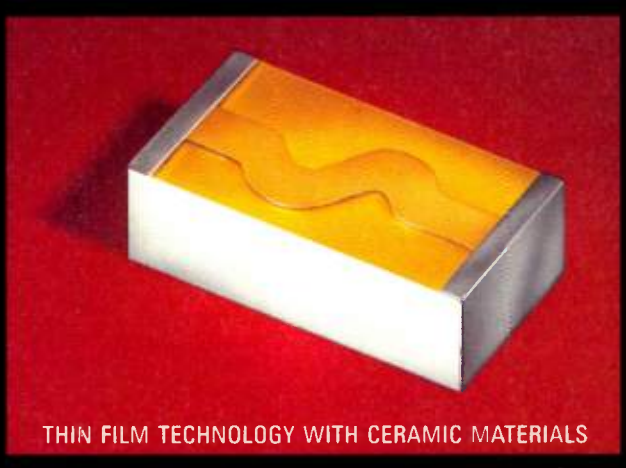

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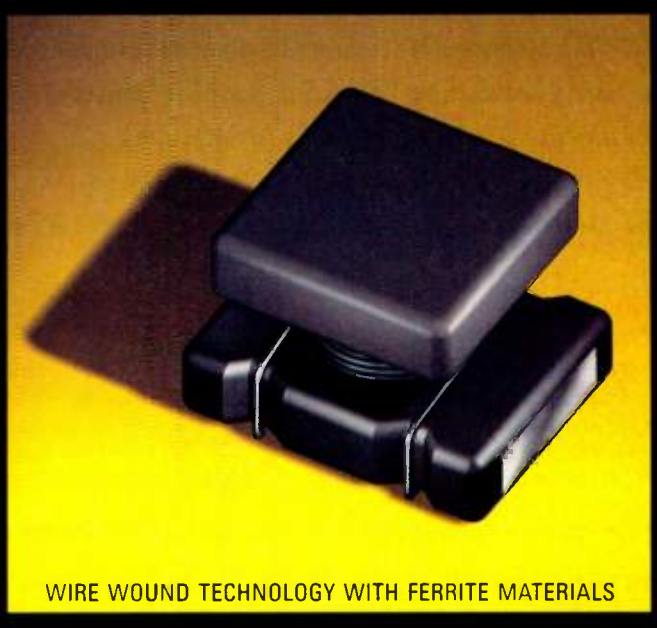

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LOOKING AHEAD: October 1, 1998

Special Digital Section: Digital IC technology is the focus of this section, which will contain a half-dozen Design Application articles on tips for using CPLDs, as well as a Special Report on CPLD technology.

Embedded Operating Systems This special report by Contributing Editor Loren Werner will examine how embedded operating systems are striving to meet the need for enhanced productivity levels.

Portable-By-Design/Wireless Supplement: Abstracts of several technical presentations made at the Wireless Symposium, as well as the Portable By Design Conference, Feb. 9-13, are contained in this supplement.

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About Electronic Design

ONLINE OVERVIEW

September 14, 1998 Volume 46, Number 21

See Electronic Design Online's Table of Contents to preview what's in store for you on the web!

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Get In On The Fun!

Beginning October 1, **Electronic Design** will be holding a contest for EEs who fancy themselves as creative writers. If you like to write short stories or enjoy composing poems, now's your chance to show off your skills. But here's the catch--your prose must contain as many names of EDA tool vendors as possible, and the piece cannot exceed 300 words in length.

The contest will run until November 30. Winners will be announced via **Electronic Design Online** on December 15, and they will be awarded one of a group of prizes donated by EDA tool vendors. Sound like fun? For further details, see our home page at **www.elecdesign.com.**

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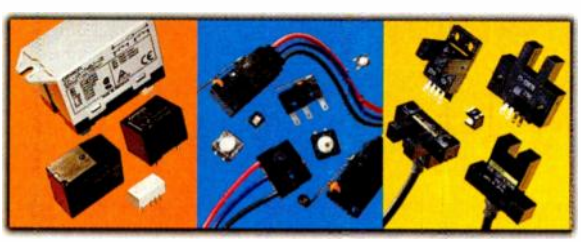

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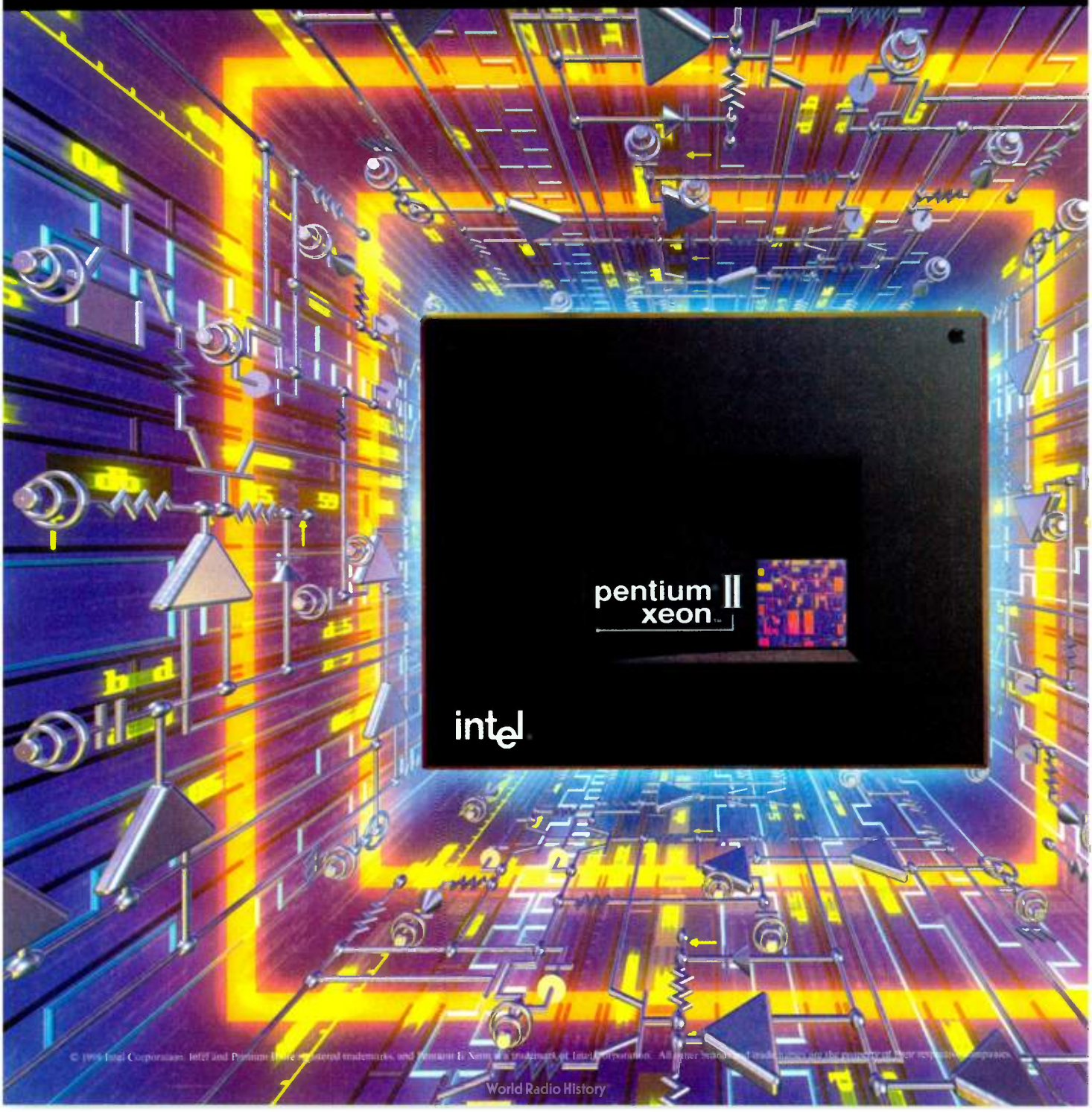

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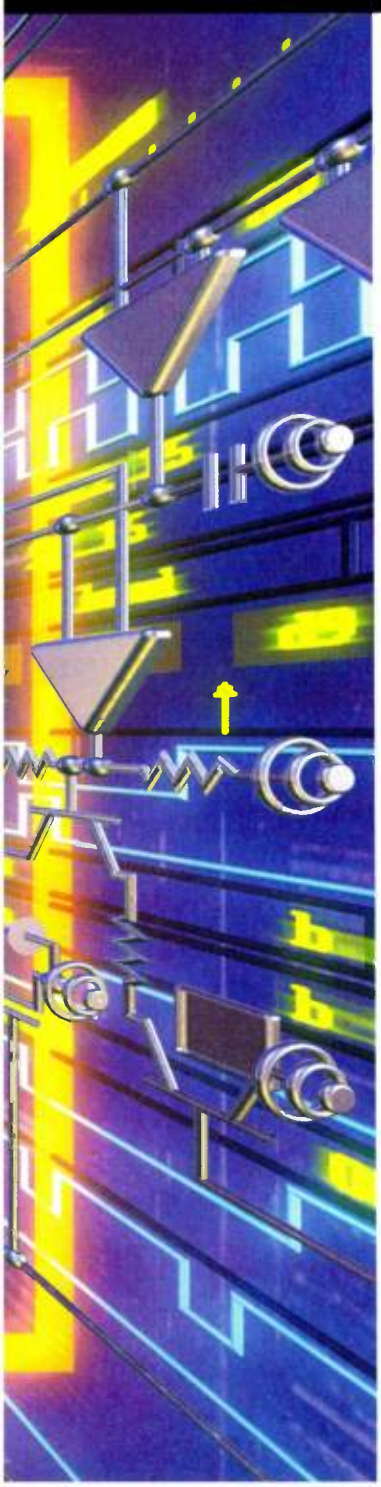

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EDITORIAL

The 1000-Year Digital Reich?

I scan a lot of business and consumer magazines because I want to know the high-tech information de jour of my non-trade editorial cousins. I'll peruse *Business Week*, *Fortune*, and *Forbes* to see which technology articles the Captains of Industry are digesting. And I'll read *UPSIDE*, *Fast Company*, and *Wired* to see what the techno-hip are reading.

Although I'm pleased to see more science and technology replacing mutual fund and retirement planning articles in the business magazines, I'm dismayed to see a lack of objective, critical analysis, and the overuse of market projections that seem a bit high at times. But, at least they're trying to inform, even if it's at a basic level. Of course, the surge in computer advertising is also a great motivator for these magazines to boost their high-tech coverage. Hey, they're capitalists writing to capitalists.

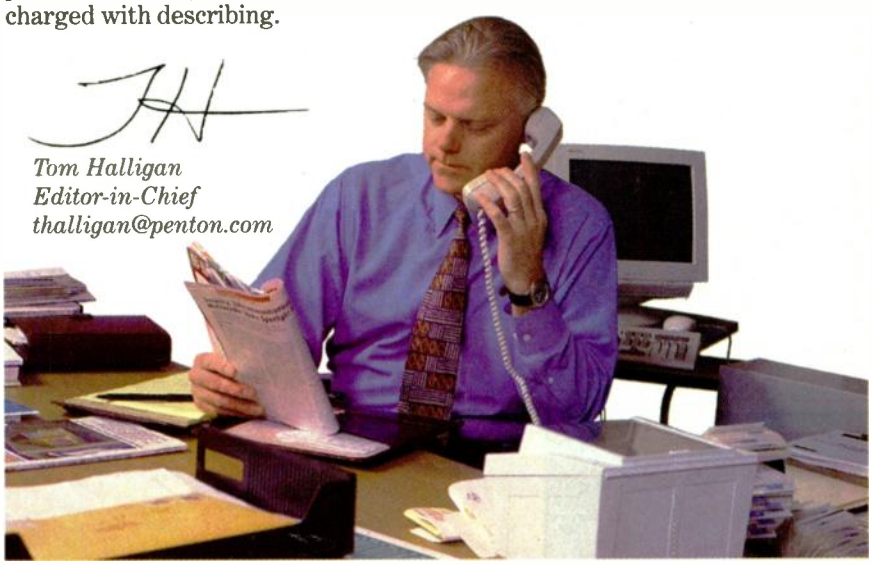
Then we have the new wave of technology magazines that are written by the technohip to a readership who want to be technohip. I coined that name after I read the cover article in the August issue of *UPSIDE* that contained the following words: technoimperialists, technofailures, technoanarchists, technoreactionaries, technoutopians, technojugen, technoabsolutism, and technofascists. (Obviously you can see why I'm in a techno state of mind right now, but I'm hoping it will wear off in a few days).

The article, and articles like it, read as if the writers all double-majored in English and history. It's amazing how many demons these writers can find under the motherboard. This particular article basically warns us that if we don't watch out, a couple of the above technogroups could be the incubator for "building the 1000-year Digital Reich." Scary? Nah. But it was a better August beach read for me than a Stephen King novel.

ELECTRONIC DESIGN and other technical trade magazines stay focused on the technology. That's definitely our mission. You go elsewhere for your general technology news and information—to sources that you trust, which probably coincide with your personal and political views. But, I do wonder if technology is getting a fair shake from the mass media. Is technology being presented fairly, accurately, and objectively? Are those general-interest business and technology writers and commentators doing a decent job?

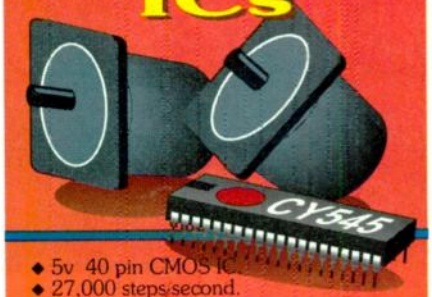
Overall, I'll give them a C rating. Their main failures are not providing well-thought-out critical analysis, and continuing to go back to the same tired "expert" sources for quotes.

As more high-tech tools creep into our daily lives, I would hope that business and general technology editors and writers will soon go beyond the popular industry analysts' quote machines, and dig deeper to find the technical people who can really help them understand and explain the technologies they are charged with describing.



Tom Halligan
Editor-in-Chief
thalligan@penton.com

Stepper Motor Control ICs



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- Many, many more features!
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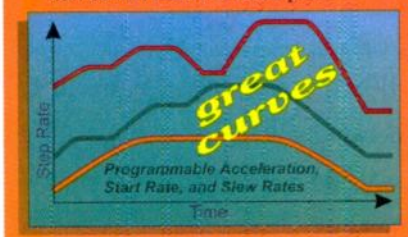

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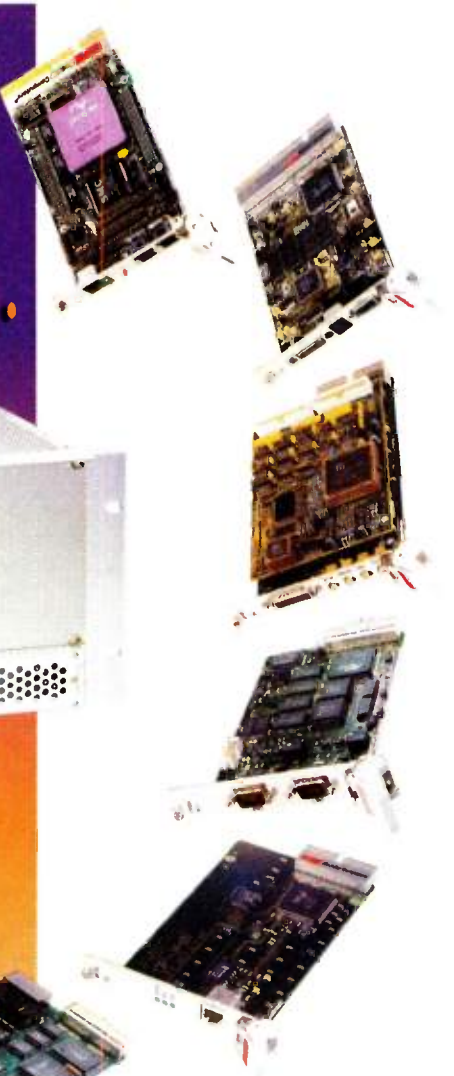

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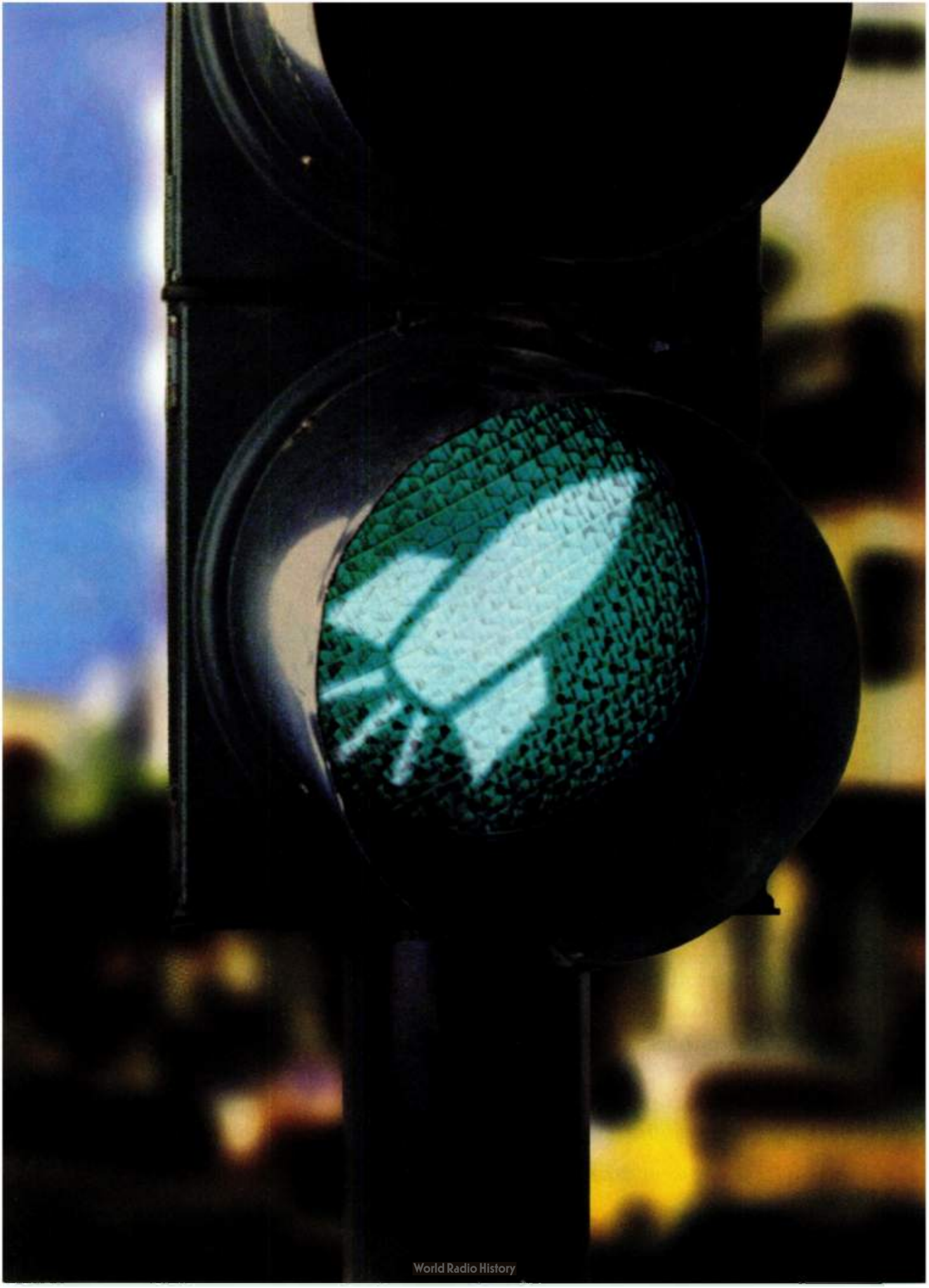

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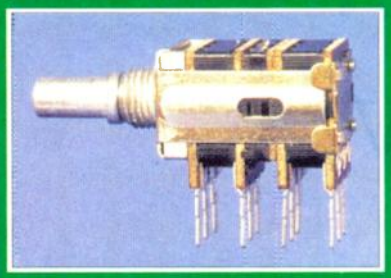

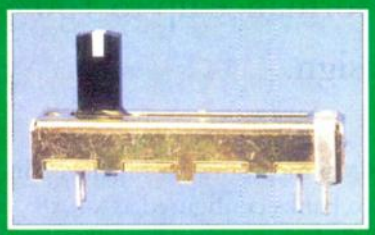

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READER SERVICE NUMBER 94

Integration Trend Builds Steam

Dictated by end systems that must continue to offer more for less, analog and mixed-signal IC manufacturers continue to refine their processes to pack more functions on the same chip. And, this is especially true in digital cellular and personal communications service (PCS) telephones that shrink so rapidly with time. Every new generation offers more features, including smaller housings that fit in a user's palm—without penalizing the battery or the wallet.

This drive is gathering momentum as semiconductor suppliers strive to put system-level solutions on a single die. While the single chip solution is far fetched for now, the level of functional integration rises ever higher. In fact, the most recent trend is to integrate power management and conversion functions on the same analog and mixed-signal chip, and offer such combinations at cost-effective prices.

Until now, the power-supply elements like voltage regulators and dc-dc converters, as well as management and supervisory functions, were always considered on a separate chip. But, with Texas Instruments' development of the LinEPIC-III analog 0.37-µm Leffective CMOS process, that chip landscape is changing. TI is now confident that such power-control functions can be integrated with the analog front-end processing functions on a single die, thereby cutting the number of components in a wireless phone.

ASHOK BINDRA
ANALOG, POWER DEVICES, & DSP

The LinEPIC is an analog/mixed-signal version of TI's digital CMOS process known as Enhanced Performance Implanted CMOS (EPIC). This third-generation technology is a high-performance, analog CMOS process with good parasitic bipolar components. Plus, it features dual gate oxides that allow 3.3-V and 7.0-V transistors on the same die. Other features of the enhanced process include precision poly-poly capacitors, high-value resistors, N+ buried layers, and other processing steps to make such integration feasible. As a result, it has enabled merging of the RF interface, audio codec, speaker drivers, and microphone preamplifier with low-dropout regulators (LDOs), switching regulators, and charging switches. This is currently implemented in custom designs for next-generation cellular terminals. Standard products using the LinEPIC III technology are slated for release sometime next year.

While the technology is cost-effective, smaller, and easier to design, it still maintains the overall system performance. In addition, the user doesn't need to worry about the power issues. Meanwhile, efforts are underway to extend this capability to include small-signal RF functions on the same chip. The result will be one integrated analog chip for the celluar market. Additionally, TI intends to extend this capability to other analog/mixed-signal product lines.

TI is not the only company that sees the significance of integrating power-control functions with analog/mixed-signal devices. In fact, Intel's design engineers embarked upon such integration with the development of multilevel flash memory cells, for example, the StratFlash high-density memory chips unveiled last year. This multibit/cell flash-memory technology required nonstandard voltages to perform accurate program and read operations, forcing designers to implement a dc-dc voltage converter on the same memory chip. While eliminating the need for an external dc-dc converter, the built-in voltage converter allows precise control of the cell voltages required to reliably and reproducibly place precise amounts of charge on the floating gate of the multibit cell.

Other analog/mixed-signal players are reviewing such a path. It won't be long until many others will join the fray. And, a new integration trend will emerge. Maybe some of you are already ahead of the game....

Send your comments on this subject to me at *abindra@penton.com*

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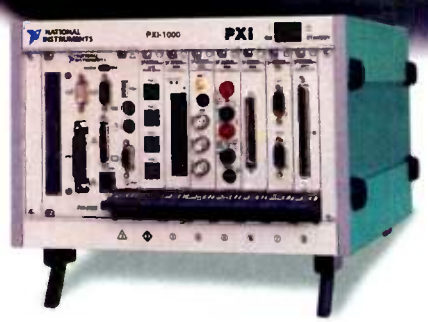

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SP503	7	7	RS-232 RS-422 RS-485 RS-449 V.35 EIA-530	+5V	7 drivers and 7 receivers, supports DTE or DCE applications
SP504	7	7	RS-232 RS-422 RS-485 RS-449 V.35 EIA-530 V.36 EIA-530A	+5V	on-chip switched resistors for simplified V.35 termination, supports DTE or DCE applications
SP505	7	7	RS-232 RS-422 RS-485 RS-449 V.35 EIA-530 V.36 EIA-530A	+5V	single chip multi-protocol serial interface transceiver no external termination resistors.
SP522	2	2	RS-232 RS-422 RS-485 RS-423	+5V, +10V, -10V	low cost multi-protocol transceiver integrated circuit, individual tri-state control
SP524	4	4	RS-232 RS-422 RS-485 RS-423	+5V, +10V, -10V	low cost multi-protocol transceiver integrated circuit, ideal for V.36 applications

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OVI Announces HDL Interoperability Standard

Open Verilog International (OVI), Los Gatos, Calif., an EDA industry organization, recently announced its approval of the Verilog HDL synthesis interoperability standard. This OVI standard specifies the RTL and behavioral coding style best suited for synthesis, as well as some of the formal pragmas and directives for new tools. Its foundation consists of a combination of contributions provided by Synopsys, Mountain View, Calif., and California-based Cadence's Synergy semantics and syntax that was used to seed the synthesis interoperability language subset.

The Verilog HDL interoperability standard ensures consistent results across a broad spectrum of applications when designers reuse designs and intellectual property from other sources. Moreover, it will provide a way to exchange and protect intellectual property. To download a copy of the standard, go to *www.eda.org/vlog-synth*. Additional information on the standard can be obtained by contacting OVI directly at (408) 358-9510; or at *www.ovi.org*. CA

Joint MEMS EDA Development Gets Underway

The MEMS (Microelectromechanical Systems) industry has virtually exploded in recent years driven by many new applications in the areas of consumer, aerospace, and telecommunications, coupled with advances in micromachining technology. To help support this growth, two prime players in the MEMS industry, Mentor Graphics, Wilsonville, Ore., and MEMSCAP, Grenoble, France, have joined forces.

The prime focus of the partnership will be to develop designs tools for MEMS-based systems. Mentor's contribution to this effort will be to leverage its expertise in the area of analog

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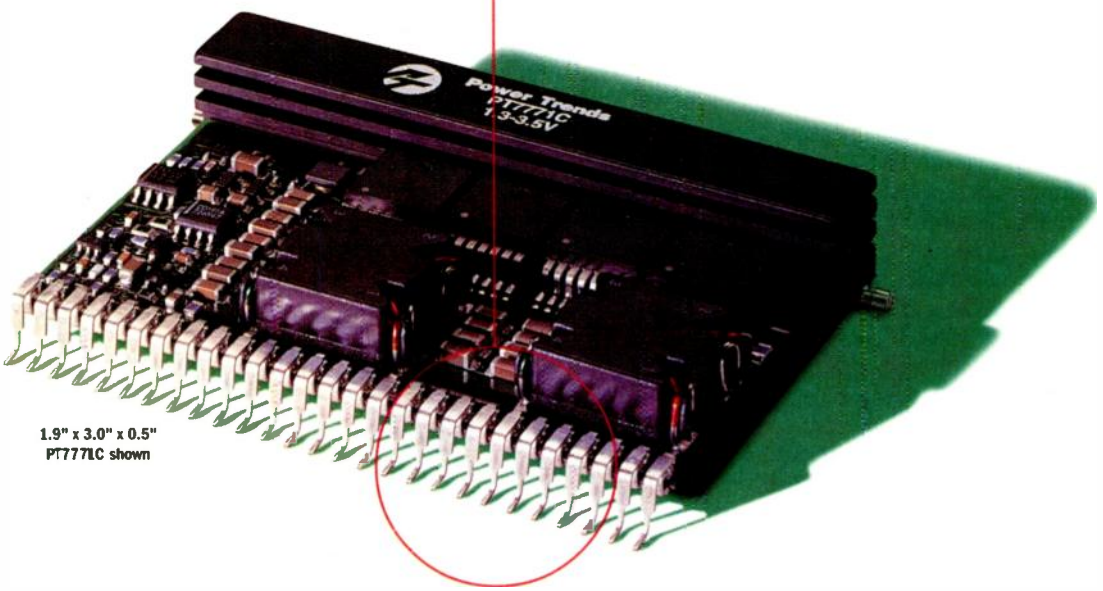
32 AMPS
SURFACE MOUNT



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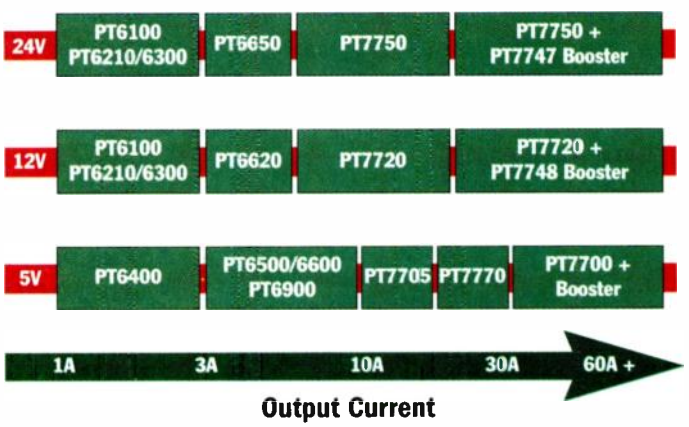

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behavioral modeling through its HDL-ATM analog behavioral language. The language is specifically tuned for multi-domain applications, such as MEMS. MEMSCAP will contribute its expertise as a provider of IP (Intellectual Property) for MEMS.

Under the terms of the partnership, the two companies will work closely with silicon foundries to provide design teams with access to MEMS components, as well as the latest process technology developments. They will develop design-for-manufacture methodologies that will improve yield and performance characteristics around Mentor's Opsim and Aspire yield management tools. In addition, the two companies also will cooperate to provide customers a range of solutions for MEMS design challenges, including the development of MEMS engineering kits that offer designers a mixed-technology MEMS design flow. Check out the *www.mentorg.com* web site. CA

Firms Team Up To Develop Biometric Verification ICs

Keyware Technologies, Boston, Mass., and ST Microelectronics, Milan, Italy, announced an agreement concerning the development of integrated circuits implementing Keyware Technologies' Layered Biometric Verification (LBV) technology. Biometrics is the science of measuring the unique physical characteristics of a person, such as a voice, a face, or a fingerprint. These personal features are analyzed and stored as "bioprints" in a reference database, on a smart card, or an embedded chip. They're used to verify the person's identity by comparing them to the previously stored bioprints.

Keyware Technologies combines several biometric technologies in one control system—called the LBV Security Server—which increases the security and reliability of the system. The system is in charge of the intelligent decision process that combines the different results, thus enhancing the performance of the biometric authentication. User-friendly and non-intrusive layered biometrics help to restrict physical access, verify identity for financial transactions, and control access to information over computer and telephony networks.

ST will implement Keyware's software on a proprietary DSP chip, creating one processor chip for video and one for audio. The voice signal processor chip also will include voice-recognition software based on technology developed by Lernout & Hauspie, Burlington, Mass., licensed to ST in 1997 and employed for car information-system applications.

Contact Keyware Technologies Inc. at (781) 933-1311, ext 230; *www.keywareusa.com*; or ST Microelectronics at +33 4 50 40 25 58; *www.st.com*. JC

GEM Satellite Program Selects Two Partners

Hughes Space and Communications Company (HSC) announced that it has chosen LogicVision and IBM to participate in its Geomobile (GEM) satellite program. Hughes GEM satellites will feature a 12.25-meter deployable reflector, on-board digital signal processing, circuit switching, and digital beam forming. Once launched, the satellites will be able to provide telephony services to users of portable cell-phone-sized handsets.

A crucial part of the communications payload is the GEM's on-orbit reconfigurable digital processor, because it enables the satellites to meet the needs of multiple customers, or adapt to the changing needs of a single customer. The first ASIC design for this digital processor is well over two million gates in size. Unfortunately, with such a high gate count and device complexity, testing the devices becomes difficult.

This is where LogicVision and IBM enter the picture. Hughes will leverage LogicVision's icBISTTM to test the devices, while IBM will exercise its expertise in building and testing reliable, highly complex, multi-million-gate devices to supply the ASICs. To date, LogicVision and IBM have completed the integration of LogicVision's icBISTTM embedded ATE solution into the IBM ASIC design flow for the SA-12 process technology. They also have begun qualifying icBISTTM for customer product-level test of designs using the IBM SA-12 design system.

For more information on the GEM satellite program, contact LogicVision at (408) 453-0146, or go to the web site at *www.logicvision.com*. CA

New Online Privacy Alliance Puts Out Guidelines

IBM, along with approximately 50 other American companies and associations, have banded together to create the Online Privacy Alliance—a cross-industry coalition that will protect the privacy of individuals in cyberspace. As its first official business, the alliance released guidelines for online privacy policies and a set of principles to safeguard the privacy of children.

The guidelines require that alliance members implement a set of privacy policies that address notice and disclosure, choice, data security, data quality and access. The alliance's children policy states that sites intended for children must not collect online contact information from a child under 13 without prior parental consent or without direct parental notification of the nature and intended use of the information.

As part of the alliance's ongoing privacy efforts, it will now focus its attention on plans for an education campaign. The campaign, designed to reach a million businesses to encourage them to adopt alliance policies and practices, will target consumers and seek to teach people how to protect personal data.

The creation of this alliance is significant because it represents the most widespread effort ever undertaken by business to create an online environment that respects privacy. The list of companies and associations are listed at the Online Privacy Alliance web site. For further details, check out IBM's web site at *www.ibm.com* or go to the Online Privacy Alliance web site at *www.privacyalliance.org*. CA

Edited by Roger Engelke

World Radio History

Forum Beefs Up Advanced Graphics Port Spec For Workstation Applications

While the Advanced Graphics Port (AGP) continues to thrive in PCs, it lacks the punch needed for advanced simulation, mechanical CAD, financial modeling, and creation of digital content. Such applications still fall within the realm of advanced graphics workstations. It was with that in mind that Intel and the AGP Forum crafted a workstation-specific extension to the AGP 2.0 specification, called AGP Pro.

Intel recently released the final version of that spec, which had been announced earlier this year. AGP Pro is designed to offer up to four times the electrical power of today's AGP interface specification. It includes an enhanced connector; improved cooling system; form factor specifications, such as graphics card size; and layout specifications to meet the demands of workstation graphics users on both IA-32 and IA-64 platforms. The new specification supports both AGP2X and AGP4X modes.

AGP Pro includes advanced capabilities like high-performance, single- and multiple-image display, integrated video and 3D functionality, and advanced realism.

Higher-Power Operation

At its heart, the purpose of AGP Pro is to deliver added electrical power to graphics add-in cards. The AGP Pro definition includes an extended connector, thermal envelope, mechanical specifications for cards, I/O brackets, and motherboard layout requirements. AGP Pro extends the existing AGP connectors on both ends to deliver additional power on the 12- and 3.3-V rails.

The specification is intended to supplement, not replace, the existing AGP connector set. While ordinary AGP supports both ATX and NLX motherboard form factors, AGP Pro is defined only for ATX form-factor implementations.

An AGP-Pro-compliant system must have two PCI slots adjacent to the AGP Pro connector. The PCI slots will guarantee at least 33-MHz/32-bit operation. As an option, the PCI slots can be used by an AGP Pro card for electrical, mechanical, or PCI functions.

AGP Pro defines two types of cards: high-power (50 to 110 W) and low-power (25 to 50 W). Both versions require sufficient space on the component side to facilitate cooling. Two adjacent PCI slots must be left unoccupied to provide this space. The unused PCI connections provide 2.17 in. of clearance space for the card.

A special three-slot-wide I/O bracket installed on the AGP Pro High-Power card will reserve the use of this space. The spec insists that all retail-channel, High-Power AGP Pro cards use the three-slot bracket. Low-Power AGP Pro cards must use a two-slot-wide bracket.

The AGP Pro connector is designed as an extension to the existing AGP connectors, which are extended on both ends to build the AGP Pro version. It is a monolithic connector.

Any of the specified AGP connectors can be extended to build the AGP Pro connector. This section illustrates the use of the Universal AGP connector to build the AGP Pro connector. The Universal connector can be replaced with 3.3- or 1.5-V AGP connectors to build the AGP Pro.

Power ID Pins

Two-pins are defined specifically for the AGP Pro connector. They're used for two purposes: indicating that an AGP Pro card is physically present in the slot, and providing information on the maximum power requirements of the card plugged into the AGP Pro connector. When providing the power level, the pin strapping must indicate the total maximum power consumption of a fully configured AGP Pro card.

The maximum power consumption may be more than that consumed in the card's shipping configuration, taking into account sockets for memory expansion, for instance. System designers may use these signals for system configuration, diagnostics, or power allocation.

If the signals are used by the motherboard, the system designer must provide pull-up resistors for both of them. Designers can chose the value of the resistor and the pull up voltage based on the associated circuitry.

Details on the AGP Pro interface specification, included as an addendum to the AGP Interface Specification Rev 2.0, can be found at www.agpforum.org. For more information, contact Jane Rauckhorst at Intel, (408) 765-7026; jane.rauckhorst@intel.com.

Jeff Child

Silicon-On-Insulator Technology Boosts Performance In Mass-Produced CMOS ICs

Researchers have apparently found the answer to a 30-year-old question—how to make high-density, silicon-on-insulator (SOI) CMOS circuits in commercial volumes. Using a process called separation by implantation of oxygen (SIMOX), scientists at the IBM Microelectronics Research Division's Advanced Silicon Technology Center, East Fishkill, N.Y., have qualified a 0.22-µm SOI CMOS process. The team is now in the early stages of developing a 0.15-µm technology.

According to Aiden Kelly, IBM's manager of custom logic design services in Europe, a number of microprocessor and SRAM ICs have been qualified, and will be debuting in IBM AS/400, S/390, and RS/6000 servers soon. Kelly says that SOI options will be offered in IBM Microelectronics' merchant catalog of standard parts before the year end. He notes that the effect on prices will be marginal, because the new process stage increases costs by less than 10% at the wafer level. Yields, he says, are unaffected.

The SIMOX process involves implantation of very heavy doses of oxygen followed by annealing at high temperatures, until a thin layer of silicon-dioxide film is formed. The result is a complete wafer with a thin layer of N++ silicon separated from the substrate by a defect-free ultra-flat layer of oxide *(Fig. 1)*.

The wafer can then be processed conventionally through standard

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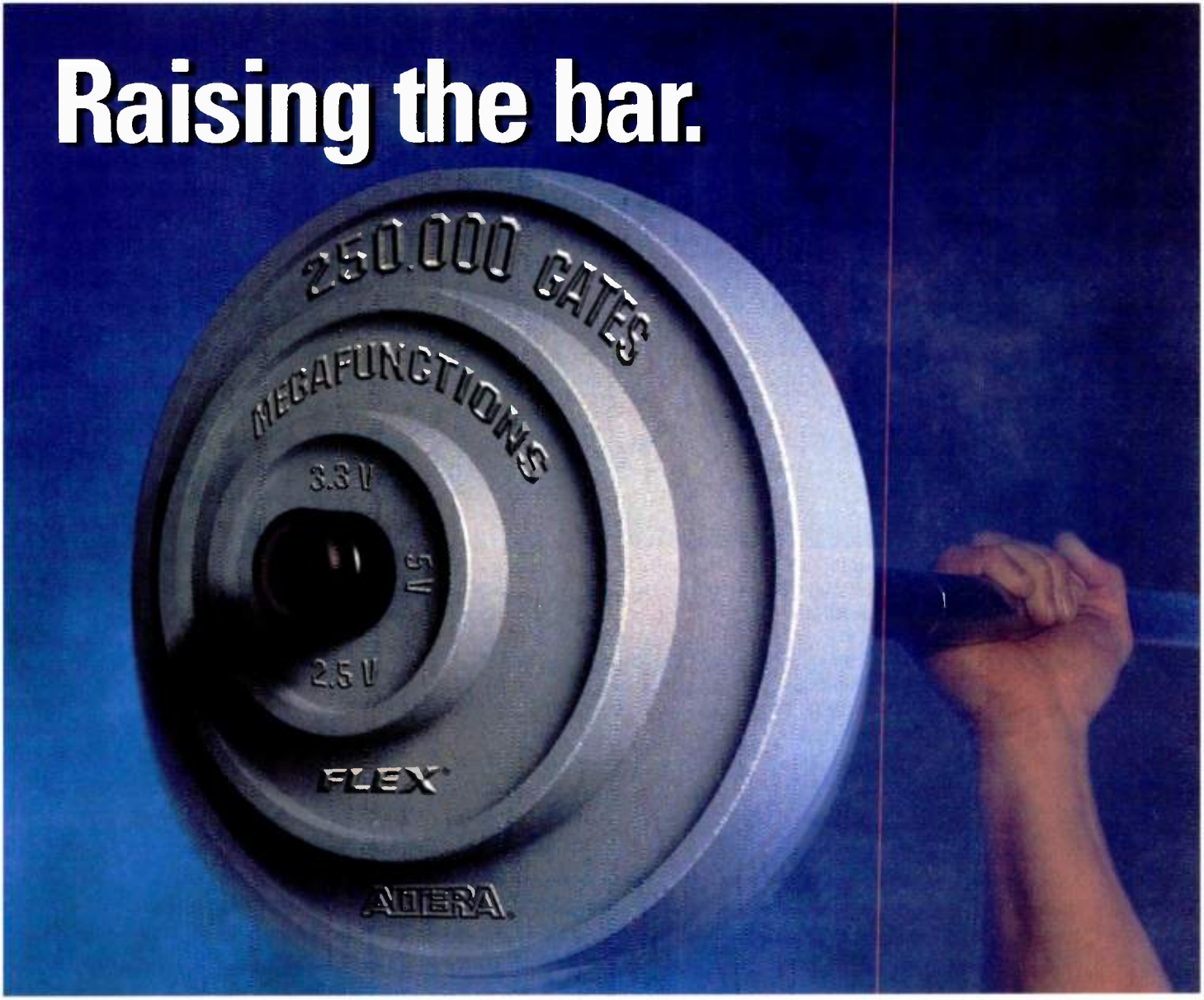

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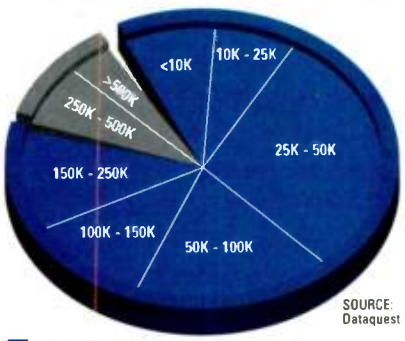
Gate Array Design Starts by Gate Count (1997)



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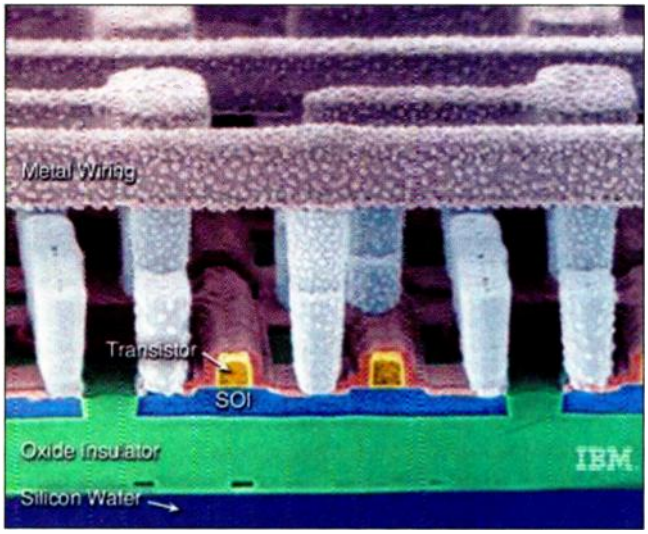
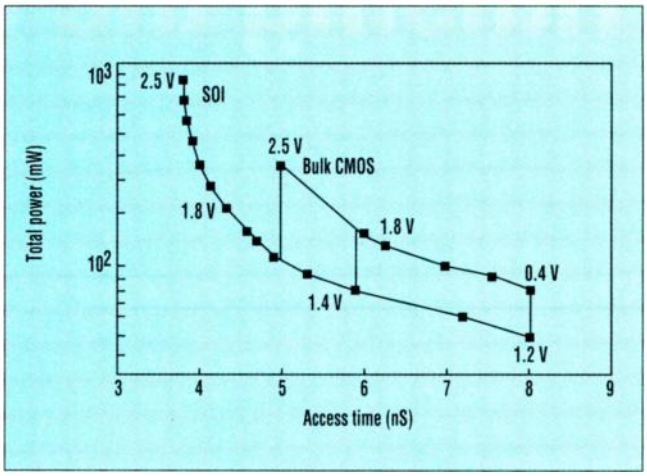


1. This cross-section photomicrograph of an IBM device built using the newly developed silicon-on-insulator (SOI) CMOS technology shows the relationship of the transistors to the SOI layer.



2. Silicon-on-insulator CMOS devices can use lower voltages than standard CMOS circuits without degrading performance. That gives them an advantage in handheld systems. For example, these measured results show that a 4-Mbit SRAM made with the SOI process consumes significantly less power for similar access speeds.

CMOS production cycles. Because implantation of the insulating layer takes place during wafer preparation "off-line," it can be applied retrospectively to all IBM Microelectronics' standard CMOS product ranges, and added to all the company's wafer fab lines.

The result is a 25% to 35% increase in performance in terms of cycle time, and up to 35% better high-frequency performance than equivalent bulk CMOS devices. This boost derives from the elimination of area junction capacitance and "body effect." In conventional CMOS circuits, this results in lower current and reduced performance in MOS transistors, if they are stacked or if their source electrodes are not grounded.

In addition to higher speeds, the SOI-based devices offer the prospect of better low-power options for handheld equipment. The reason is that compared with standard CMOS circuits, lower voltages can be used in SOI CMOS without degrading performance. As an example, Kelly cites the case of a 4-Mbit SRAM made with the SOI technique. Compared with a standard CMOS device, IBM engineers say they measured a significant reduction in power consumption for a similar access speed *(Fig. 2)*.

Other benefits claimed include a significant reduction in "soft error" rates. These are errors caused by the impact of cosmic rays, and background radioactivity upsetting data held in memory. As device geometries get smaller and operating voltages ever lower, these effects become more significant. In fact, interest in SOI technology was first developed as a way to harden silicon devices against radiation for space applications.

Peter Fletcher

Hot-Plug, Limited Bus-Mastering Retry Time Highlight PCI Version 2.2 Specification

Now finished with a 30-day member review, version 2.2 of the Peripheral Component Interconnect (PCI) specification is ready for prime time. The latest version of the PCI standard includes the new functionality of PCI Hot-Plug and PCI Power Management, in addition to a roll-up of engineering change notices (ECNs) and errata since version 2.1 was completed in 1995 *(see the table)*. While the latest update is essentially a "clarification release" of the spec, a number of recent additions may have interesting implications for multimedia and interrupt handling.

The major elements of PCI version 2.2—PCI Hot-Plug and PCI Power Management—have been in the works since last fall, and contain no major surprises. The former allows users to insert and remove PCI adapter cards without shutting down the system. The latter addresses the issues of power management and energy conservation on the PCI bus. Warren Questo, chair of the of the PCI Special Interest Group (SIG) reports that the comments received during the member review period involved mostly minor issues on mechanical concerns and, in fact, were primarily requests for clarifications.

Two of the more recent additions to version 2.2 include a maximum retry time for bus-mastering requests, and support for message-signaled interrupts. The only major point on which there was significant comment was on maximum retry time, which prevents any device on a PCI bus from monopolizing it. While several device classes have been guilty of that, graphics boards were the worst offenders. There had been some worry among graphics vendors that a limit on retry would hurt performance benchmarks of their products.

Avoids Data Losses

Because PCI supports bus mastering, any device can become a master on the bus at any time. To do so, a device has to get the attention of the controller (the Northbridge part of a PC chip set.) Without a limit on the retry time, a device can keep trying until an overhead loop occurs, and buffers must handle the data build up. Be-

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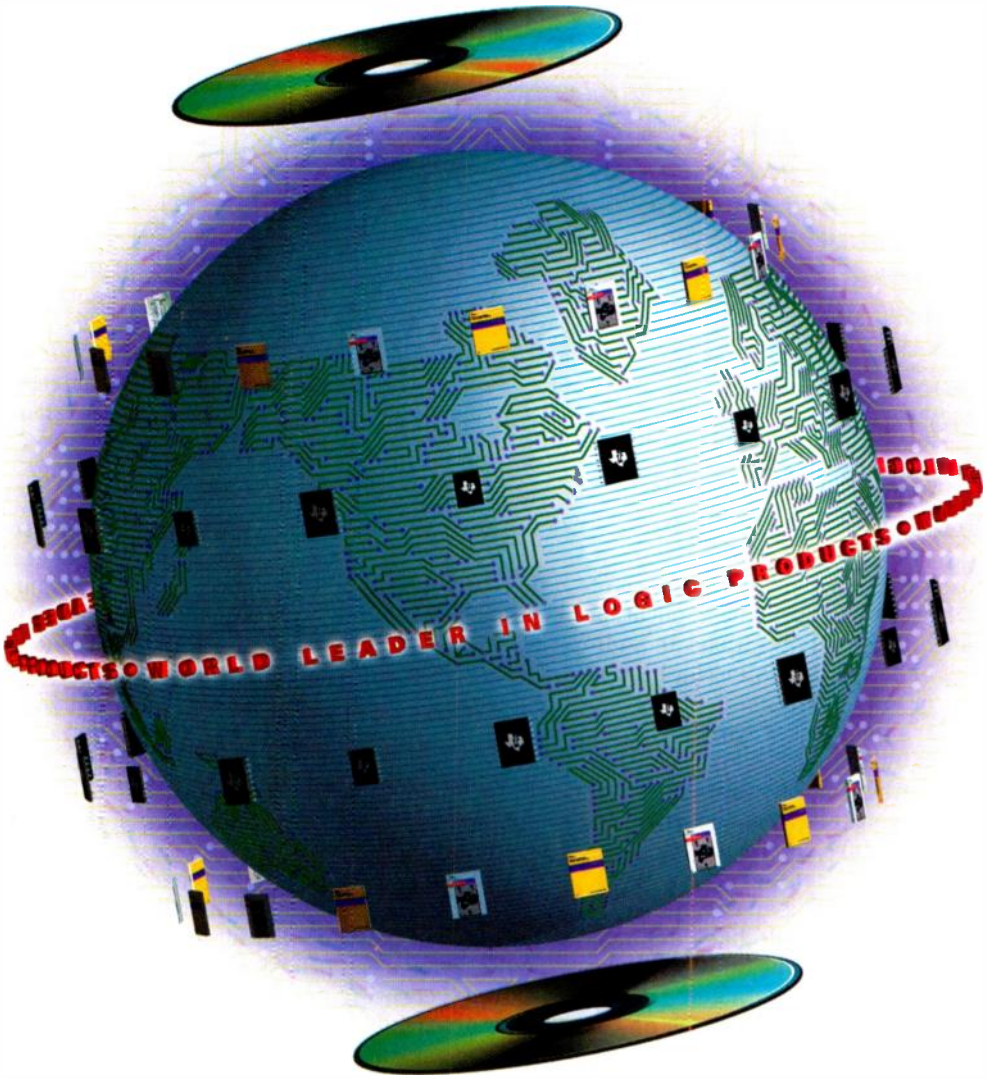

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PCI LOCAL BUS VERSION 2.2 MAJOR ECNs

ECN	Software change	Type of change	Required/ Optional	Description
Subvendor ID	X	Enhancement	Required	Subvendor configuration space.
Maximum retry time		Enhancement	Required	Devices cannot retry request for longer than 10 µs.
Message-signaled interrupts	X	Enhancement	Optional	Method for I/O controllers to send message-based interrupt signals.
3.3-V auxiliary signal (PCI Power Management)		Enhancement	Optional	Assigns reserved pin as 3.3-V auxiliary supply for wake-event logic.
PCI Hot-Plug	X	Enhancement	Optional	Ability to insert and remove PCI adapter cards without shutting down the system.

cause buffers are only so big, data is often lost. In a multimedia application, that data loss shows up as an audio click or a pop, and missing bars of video or graphics frames.

That's the problem version 2.2 addresses by limiting the bus master request retry time. At first there was some resistance, but the graphics board vendors warmed to the idea eventually. Because everyone would have to follow this maximum retry rule, no board would have a benchmark advantage. The limit also helps ensure isochronous data flow. According to Questo, the feedback on the maximum retry rule has now been resolved to everyone's satisfaction.

In general, PCI issues are becoming less relevant for vendors of graphics boards anyway. Just about all of the graphics chip and board makers are migrating to the Accelerated Graphics Port (AGP) which is faster that PCI. Unlike PCI, AGP is a point-to-point link, and has all the built-in structure to handle high-performance graphics operations.

We Interrupt This Message

Another recent addition to the PCI 2.2 spec is message-signaled interrupts (MSI). By getting around PCI's limited interrupt capacities, MSI may have important implications for both high-end and low-end system designs. MSI adds to the PCI spec a scheme for doing message-based interrupts.

PCI supports 12 usable interrupts, which are routable on only four PCI bus signals. The interrupt controller can share interrupt pins. This limitation hasn't been a problem for most PC systems because most hosts only need interrupts for four card slots. MSI lets you add interrupts, not in hardware, but with software messaging. The system posts an interrupt message to the host, and the host services that interrupt when it gets the message. The number of message-based interrupts is virtually unlimited.

MSI requires more overhead, and isn't as fast as a hardware interrupt, but it gives designers a great deal of flexibility. You can prioritize your interrupts, creating a large interrupt structure, while reserving the more important stuff for your hardwired interrupts. This is particularly important for PCI bridge operations.

MSI also lets designers reduce costs by opting to eliminate a hardware interrupt scheme altogether. Using MSI you can create a pathway for interrupts via software, and save $2 or $3 on interrupt-control silicon. Such savings aren't trivial in the multimillion-unit desktop PC business.

PCI Spec Matures

According to Questo, the success of the PCI bus is reaching a new plateau. "Even though the spec itself is starting to reach its change maturity, the actual applications of the PCI bus have not reached maturity," he says. "In fact we see it moving into more and more areas [beyond the PC]."

Although the PCI SIG actually writes an ECN for every major change to the specification, the difficult logistics require the official revisions to encompass a collection of changes. "It would have been overwhelming in logistics to do a complete revision of the document every time we did an ECN," says Questo.

"On the other hand, it would be equally difficult if we held them all to ourselves and released the spec for review all at once. It takes a little longer to do it this way, but it keeps everyone involved. That's key because it is their specification [the members of PCI SIG]. It's an open-developers community," he says.

The PCI SIG now includes over 800 member companies worldwide, each of which is entitled to see the changes to the spec and offer feedback on them. This number is up from 600 members in 1996.

For more information, contact PCI SIG at (800) 433-5177 (within the U.S.), fax the group at (503) 693-8344, or visit the PCI SIG web site at www.pcisig.com.

Jeff Child

Lone-Transistor Memory Cells Deliver SRAM-Like Speed With DRAM-Like Density

When it comes to selecting which type of memory to use, most designers follow a basic premise: For speed and ease of use, choose static RAMs; for density, use dynamic RAMs. Now, designers at Mosys Inc., Sunnyvale, Calif., have found a way to combine the best features of each. The technique they developed will be used in several new families of memory chips that function just like SRAMs, but employ the very dense, single-transistor memory cells found in DRAMs. Over the years, designers at various companies developed pseudostatic RAMs, as well as several other self-refreshing DRAMs. But, such memories performed no better than standard, slow DRAMs.

The novel 1-T SRAM structure developed by Mosys changes that. By delivering memory chips that offer random read or write cycle times of less than 10 ns, such memories can op-

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erate in systems with CPU bus speeds of up to 133 MHz. Even faster versions, with external access times of less than 5 ns, are in development.

The technology is basically a superset of the MCache technology unveiled by the company a few years ago. But, it eliminates the shortcomings of that technology—the most critical of which was the "transparency" issue. The new chips can function just like SRAMs. And, unlike MCache chips, they require no changes to any control signals. Designers just drop them into the same system without changing anything surrounding the memory.

At the heart of the 1-T SRAM is, of course, the single-transistor/single capacitor DRAM memory cell. In contrast to the four- or six-transistor SRAM cells, these allow at least a five- to 15-fold reduction in area and a four-fold increase in density.

Outside the 1-T memory array, however, is where Mosys designers work their magic. They developed an improved version of their multibank memory architecture, which employs a fast charge-sensing technology and various patented circuit approaches. As a result, logic on the memory chip manages the internal refresh of the memory cells totally transparently. This architecture exacts no system overhead penalty in access time or other performance-critical parameters. In fact, the first implementations will be a family of pipeline burst cache memories. They can drop directly into the sockets now occupied by the full SRAM-based chips.

The fast charge-sensing scheme eliminates dc power consumption in the memory sense amplifiers, while offering fast access to the data. Thus, the scheme reduces memory power consumption. In addition, the multibank memory architecture permits the company to implement dynamic power management. Because only a small portion of the memory array must be active during an access cycle, overall chip power also is lessened. Furthermore, the small memory array size provided by the 1-T cells means shorter wire lengths, which reduces the overall parasitic capacitance and resistance. Since signal propagation delays are shorter, that decreases the power losses due to signal switching and improves the memory's overall performance.

Thus, the combination of the small cell and innovative circuit techniques allows the 1-T SRAM to achieve very low operating power levels compared to similar capacity and performance SRAMs. For a 64-kword-by-64-bit, pipeline-burst cache memory implemented with the technology, Mosys estimates that the chip power consumption is only about 10% to 20% that of the equivalent SRAM version. The chip area is only about 25% that of the SRAM, which lowers the manufacturing cost. Furthermore, the lower power levels consumed by the chips reduces the heat that must be dissipated, and that improves the long-term reliability of both the chips and the system.

For more information, check out www.mosys.com.

Dave Bursky

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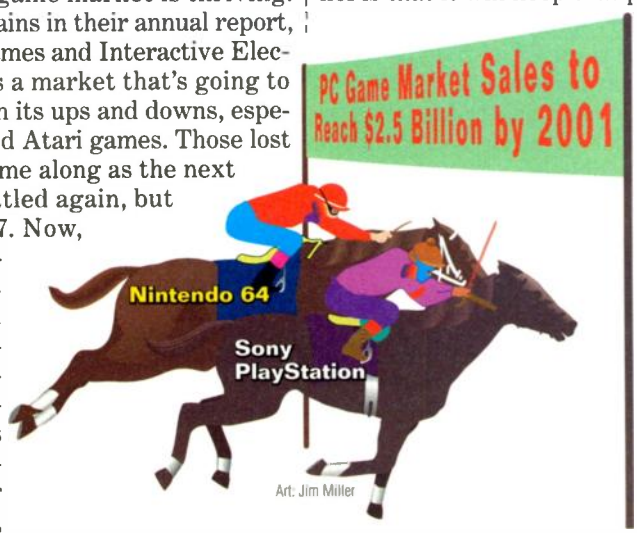
ELECTRONIC DESIGN QUICK LOOK

Edited by Debra Schiff and Nancy Konish

MARKET FACTS

Video Game Giants Are Neck And Neck For The Profit

Most of us have seen those silly commercials featuring people dressed up like characters from popular video games. Or, we've been visually inundated with fast-moving, flashy action scenes from the games themselves. The commercials are so prevalent and the products are so well known, they've become part of our pop culture vocabulary. Find one person who doesn't see the word "PlayStation" and automatically hear it pronounced by that computerized-sounding voice. The point is, why this huge resurgence in video game advertising? Basically, because the video game market is thriving. And, as DFC Intelligence explains in their annual report, "The U.S. Market for Video Games and Interactive Electronic Entertainment," this is a market that's going to keep on growing. It's sure seen its ups and downs, especially thinking back to those old Atari games. Those lost their appeal, and Nintendo came along as the next major player. The market settled again, but then began rebuilding in 1997. Now, Nintendo and Sony PlayStation are the two major players competing for the market. With video games, once a product or brand becomes established as the one most commonly bought and owned, it's easy to increase profits by creating new games and other side products. David Cole, DFC Intelligence president, sees 1997 as the year in which the Nintendo 64 and Sony PlayStation both set down those roots, establishing themselves in homes across America. U.S. sales rose 26% that year, which brought them up to $6.66 billion. Out of this growth, there was a 40% rise in video game software. PC games shot up 20%. So, it looks like Sony and Nintendo are basically neck and neck for these profits and the market share. Differences do exist, however, because each company has cornered their own segment of the market. The Sony PlayStation generally reaches an audience 14 and older, while the Nintendo 64 is favored by a younger crowd. One question that has arisen is whether Nintendo's growing focus on sports games and role-playing games can help boost its market share in the older segment. Those types of games usually attract more teens and adults. If that indeed happens, Nintendo may pull ahead of Sony PlayStation in both revenues and market share. The race is on because there is more money to be made. This year is predicted to finish up with continued growth. Video game software should see another 40% increase in sales, as PC games are expected to hold steady with another 20% rise. Predictions say profits will then peak in 1999. The DFC post-1999 forecast looks a little unstable. Since Sony PlayStation has gained somewhat of a lead, the initial belief is that it will keep that position, selling more than 14 million hardware units by the end of 1998. But, with 11 million hardware units predicted for that same year, Nintendo 64 isn't lagging far behind. And, as previously mentioned, if Nintendo 64 keeps nosing into Sony's market, it might not be Nintendo that's losing ground. But, all this might be for naught because by late 1999, consumers will probably be itching for the next new thing. And, there'll be someone there to give it to them. Sega's cooking up a new system, and there's even rumor of a successor to the Sony PlayStation. If the Sega turns out to be the new, most sought-after video game hardware system, Sony and Nintendo might be put out to pasture. Or, they'll keep their pace into the year 2000 and even 2001. Whatever the outcome, the market is expected to keep its steady growth, reaching sales of $2.5 billion by 2001. Beyond 2001, there is concern over whether the industry will once again suffer a recession as it makes the transition to another new game system. It's too early in the race to tell, but be sure to keep an eye on it. It'll probably be a photo finish.



To obtain the market review and forecast, contact DFC Intelligence, P.O. Box 720673, San Diego, CA 92172; (619) 484-5145; fax (619) 484-0819; or visit their web site at www.dfcint.com.—NK

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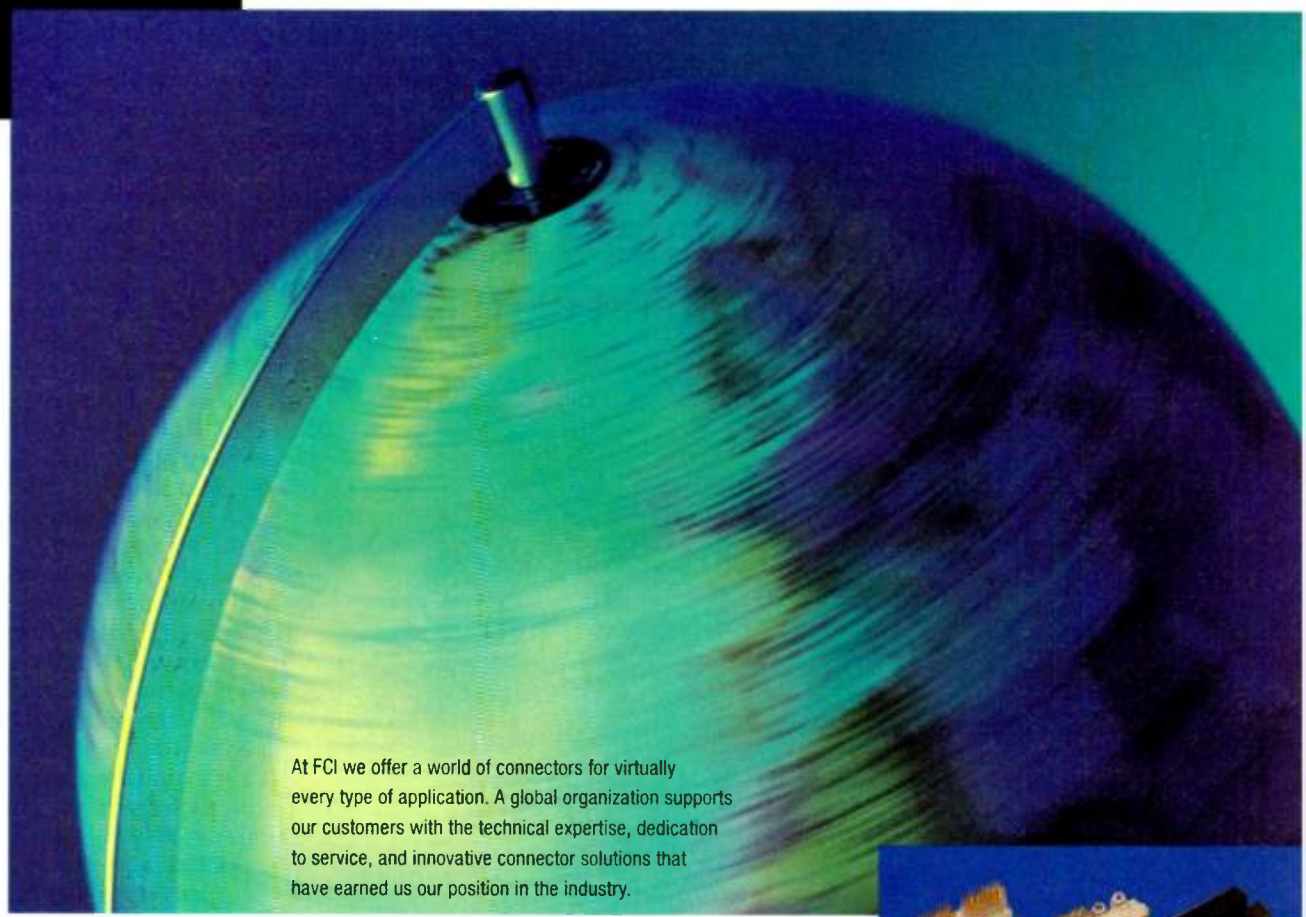

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World Radio History

MANAGING THE DESIGN FACTORY

Attack Of The Space Police

DON REINERTSEN

Many strange tales are told late at night, in engineering departments, by the eerie glow of cathode-ray tubes, but none so strange as those of the Space Police. These entities of superhuman strength are capable of making partitions move to distant corners of the building, and arranging chairs and tables in strange geometrical patterns, reminiscent of the mysterious crop circles in English cornfields. Many years ago, a project manager at a large telecommunications company related such a tale to me. It still gives me chills to think of it.

"We had just started a project with a large team. I had a standard office with a desk and chair. As team leader, I thought it'd be useful to have a table and chairs in my office, so that I could meet with other team members. Being naive and resourceful, we found an unused table out in no-man's land, and moved it into my office. It worked fine."

"The next morning, we discovered our work had mysteriously come undone. As if responding to an unknown power, the table and chairs had moved back to their original spot. Searching for a natural explanation, we assumed it was an overly zealous cleaning crew. Little did we realize that something far more powerful was at work."

"Being engineers, we were not unaccustomed to things going awry on our first try, so we moved the table and chairs back again. We left special instructions in several languages. 'No mueva la mesa! Don't move the table!'"

"The following day, we returned to discover that our work had been undone again. It was starting to get spooky. We found a mysterious note on the table this time. It looked like a corporate form, but not one that anybody had ever seen before—a Furniture Anomaly Reporting Ticket. The form said that it was a violation of corporate rules to have a large square table in the office of a team leader. Such tables were only for common meeting areas. The 'second violation' box was ominously checked. Large red letters warned that a third violation would trigger the 'SEVEREST' consequences."

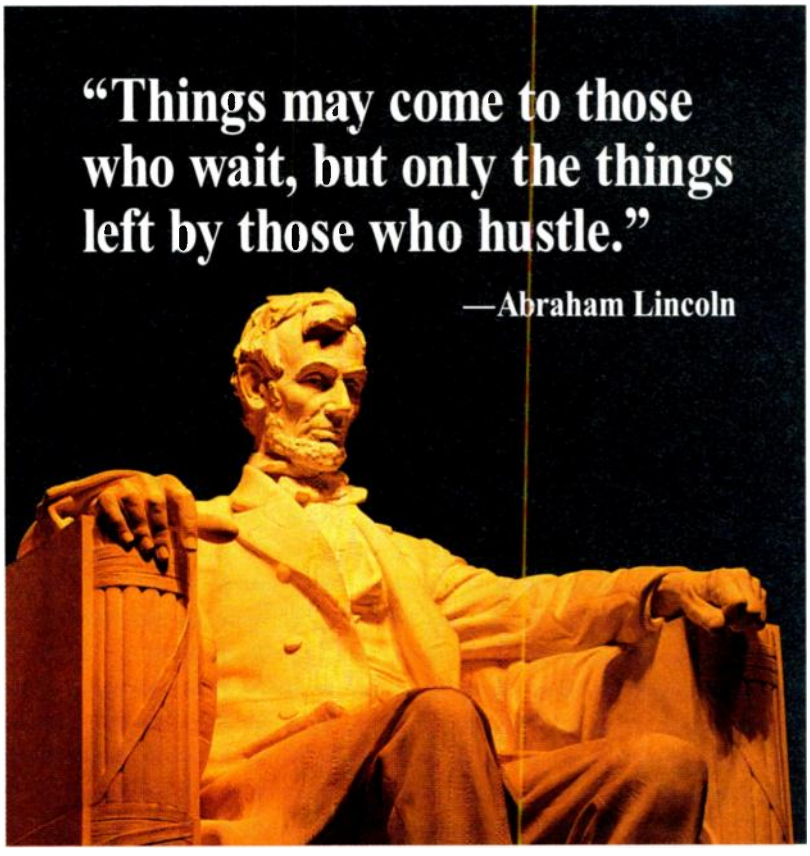
"At first discouraged, we later realized that it's wisely said that every problem contains the seeds of its own solution. We found a *round* table and moved it into my office. The Space Police had no instructions for round tables, so the table stayed there that night, and for the rest of the project."

"What did we learn from this? It's hard to put such a profound experience into words. We didn't try to beat the Space Police with raw power; that would have been suicide. Instead, we discovered that their enormous power was not matched with an equally enormous intelligence, and this proved to be their weak spot. If you can't wear them out, at least you can outsmart them."

Some of you may not have been around long enough to encounter the Space Police. Do not assume that they can't exist. Instead, try a simple experiment. Before you go on your next vacation, align your partitions at a 45° angle from those of your neighbors. Then, wait and see.

Forces far more powerful than you can imagine are at work ensuring that all partitions on the planet Earth run North-South and East-West. If they did not, the very fabric of the universe might come unraveled, with consequences we could only imagine.

Don Reinertsen is president of Reinertsen & Associates, a consulting firm specializing in product development management. He can be reached at (310) 373-5332 or e-mail: DonReinertsen@compuserve.com.



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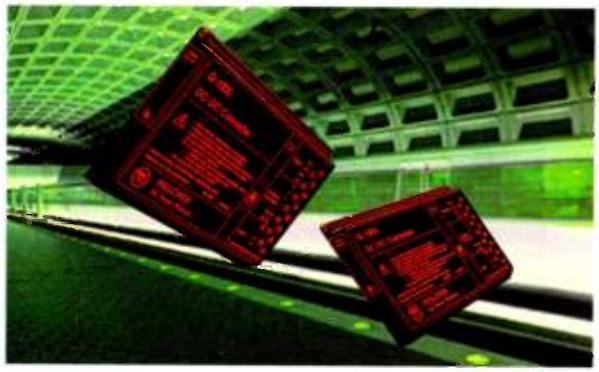

Melcher's 100 W DC-DC sets new standard for railway industry.

Melcher is already the world leader in the provision of power supplies for use in trackside and railborne applications. we have established de facto standards in the industry with the M, K and S families of DC-DC converters. Now we are establishing a new lead with the Q- family of DC-DC Converters which are compliant with the latest harmonized European railway standard EN 50155 as well as the EMC directive. Featuring five different input voltage ranges from 14.4 to 168 V DC the units are suited to 24, 36, 48, 72 and 110 V DC traction batteries, and offer 100 W from a 3U x 4 TE x 160mm extruded aluminum case, free air rated to 71°C without derating. When operated to 50°C the output power increases to a maximum 144 W.

The ultra-slim profile of 20 mm is achieved by the use of a planar transformer, together with hybrid control circuits and a conversion efficiency of up to 90% to minimise losses and heatsinking. Single and dual output modules are available providing 5 to 48 V, or ±5 to ±24 V DC rails with external adjustment possibility in the range from 50 to 110% of $U_{o\ nom}$. Safety isolation levels are according to EN 60950 with approvals from UL and LGA. RFI performance is below EN 55011/22 level B, and transient susceptibility is according to specifications IEC/EN 61000-4-2, -3, -4 and -5.

4 W DC-DC Uses Planar Technology.

Melcher has released a new family of 4 watt DC-DC converters which set new standards for performance within a 24 pin DIL package. Designated IMX 4 series, the products feature a unique single substrate planar magnetic construction, with all components in SMD format mounted directly to a single multi-layer PCB which also forms the main isolating transformer.

This construction together with a high conversion efficiency of typically 82% has enabled Melcher to increase output power from the industry standard 3 W to 4 W, which reduces the profile to just 8.5 mm. At the same time, Melcher has increased the input voltage range to a very wide 4 :1 ratio, with a choice of either 8.4...36 V DC, 16.8...75 V DC or 40...121 V DC to suit 12, 24, 36, 48 and 72 V DC nominal systems. Available with single and dual outputs from 3.3 V DC to 24 V DC, the units are no load and short-circuit proof, and are fully rated over the ambient temperature range -25...71°C. An extended temperature range version of -40... 85°C is also available as an option. Isolation voltage is a standard 1500 V DC. The units offer excellent electrical immunity, complying with IEC/EN 61000-4-2, -3, -4, -5, and -6, and are UL, cUL, and LGA approved to IEC/EN 60950.

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MELCHER The Power Partners.

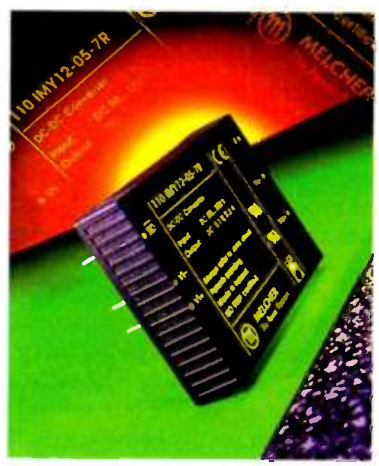
New Databook introduces 35 new products.

Melcher has introduced a new 1100 page databook which details many new lines of innovative AC-DC and DC-DC converters. The databook is also an invaluable reference on standards in the power supply industry.

Melcher manufactures more than 70 families of products, and are one of Europe's leading manufacturers for telecoms, industrial, transportation and military applications.

The databook is available in CD-ROM format. Data can also be downloaded from Melcher's website: www.melcher-power.com

NEW 12/15 W DC-DCs In 2" x 1.5" Package



Melcher has introduced two new ranges of 12 W and 15 W DC-DC converters featuring the latest single substrate planar construction. It offers unparalleled levels of performance in a compact case measuring 51 mm x 40.6 mm with a profile of just 10.5 mm. The IMX- and IMY-families are suited to "Rugged" grade applications and offers up to 17 W of output power from ultra-wide input ranges of 8.4...36 V DC, 16.8...75 V DC and 50...150 V DC. The IMS 15-family provides 17 W output power from input ranges of 14...36 V DC and 36...75 V DC and is suited to "Industrial" grade applications. Both families offer single and dual outputs from 3.3 V DC to 24 V DC and are fully rated over the temperature range -25...71°C. The IMX and IMY units are also available with an extended temperature range of -40...85°C.

World Radio History

Food For Thought

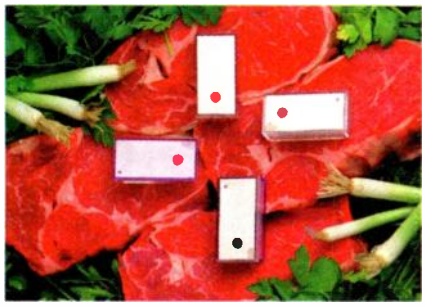
We've all heard the news about unsafe meat-handling practices and the potentially disastrous effects of eating improperly cooked meat. But, who's given thought to the transportation of frozen meat products? If food thaws on the delivery truck and is then refrozen, you wouldn't be able to tell it wasn't fit to eat. You might even purchase it.

Unfortunately, it seems that for most consumers, getting good, safe meat is strictly luck of the draw. But what if there was a way to stack the odds in our favor? Thanks to David Martinez, manager at Sandia National Laboratories, Albuquerque, N.M., and Mo Shahinpoor, engineering professor at the University of New Mexico, we may now have an option. With a little help from the electronics industry, they've developed a simple, low-cost, refrozen food detector that determines when food is not fit to eat.

This innovative invention is a by-product of a solar research project at Sandia. According to codeveloper David Martinez, it depends on an inexpensive "smart" material—a thin wire that "remembers multiple shapes and acts as a sensor." The wire is about the size of a piece of thread and less than 3/8 in. long. It can easily be mass produced using conventional manufacturing processes. Costing just a few pennies for the raw materials, the refrozen food detector is also a very cost-effective solution.

The detector does not require a power source to operate, other than warming and cooling. As the wire's temperature rises above 32° F—the point above which harmful bacteria multiply—the shape of the wire changes. The wire moves, tearing a green-colored piece of paper and revealing a red piece underneath. If the wire's temperature drops below freezing again, the wire returns to its prior position, but the color does not change because the paper has already torn. As a result, the red warning color constantly remains visible.

This detector can easily be placed with meat or any other frozen product during transport. If the product has begun to spoil in any way due to temperature change, the handler will



know simply by checking the indicator's color.

While the device itself is quite simplistic, its potential should not be underestimated. It could save the consumer from suffering everything from a mild bout of food poisoning to perhaps even death. Spoiled food is believed to cause a large number of unexplained illnesses each year.

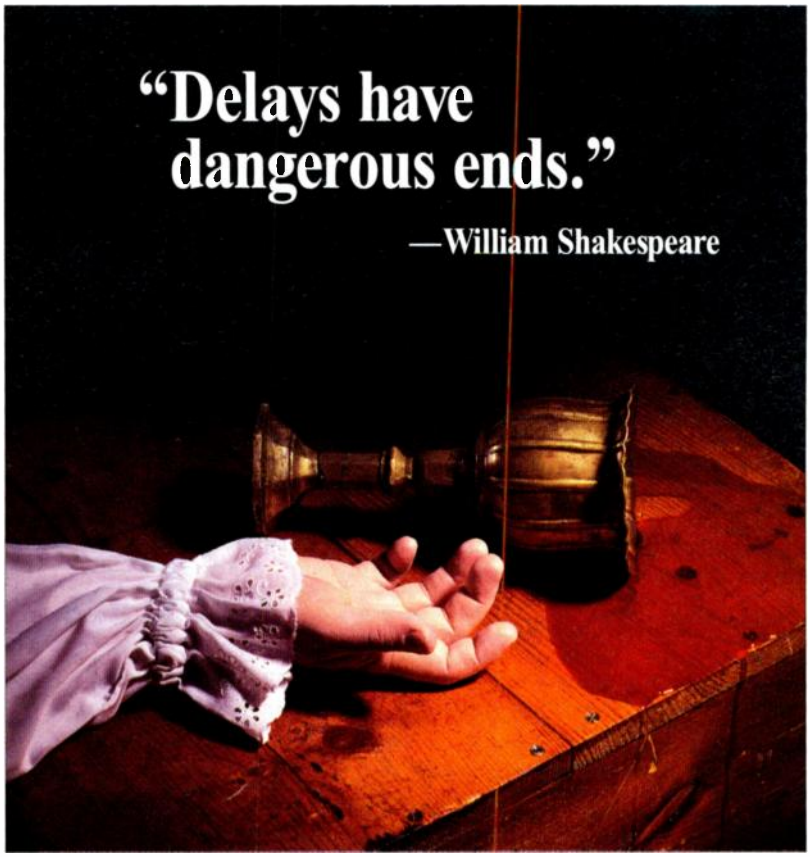
To date, eight preliminary designs have been developed and patented by the detector's codevelopers. Each design has the smart-material sensor as its key component, and works by exposing a color-coded paper. The smart material used in the designs is nitinol—a combination of nickel and titanium.

The thaw indicator sensor is not yet commercially available. It is, however, being looked at by the New Mexico-based Waste Education and Research Consortium (WERC)—a consortium interested in commercializing certain technologies concerning food safety. Talks are now underway between WERC, the U.S. Department of Agriculture, and the U.S. Food and Drug Administration.

As Martinez explains, "When there's pressure from Washington on food processors, transporters, and displayers to protect consumers against spoiled food, we have a technology patented to do just that." Until then, what's the best low-tech solution to this problem? Keep handling your meat or other frozen food properly. More than anything, cook it well.

For more information on this detector, contact Sandia National Laboratories at (505) 844-8066 or check out its web site at www.sandia.gov.

Cheryl Ajluni



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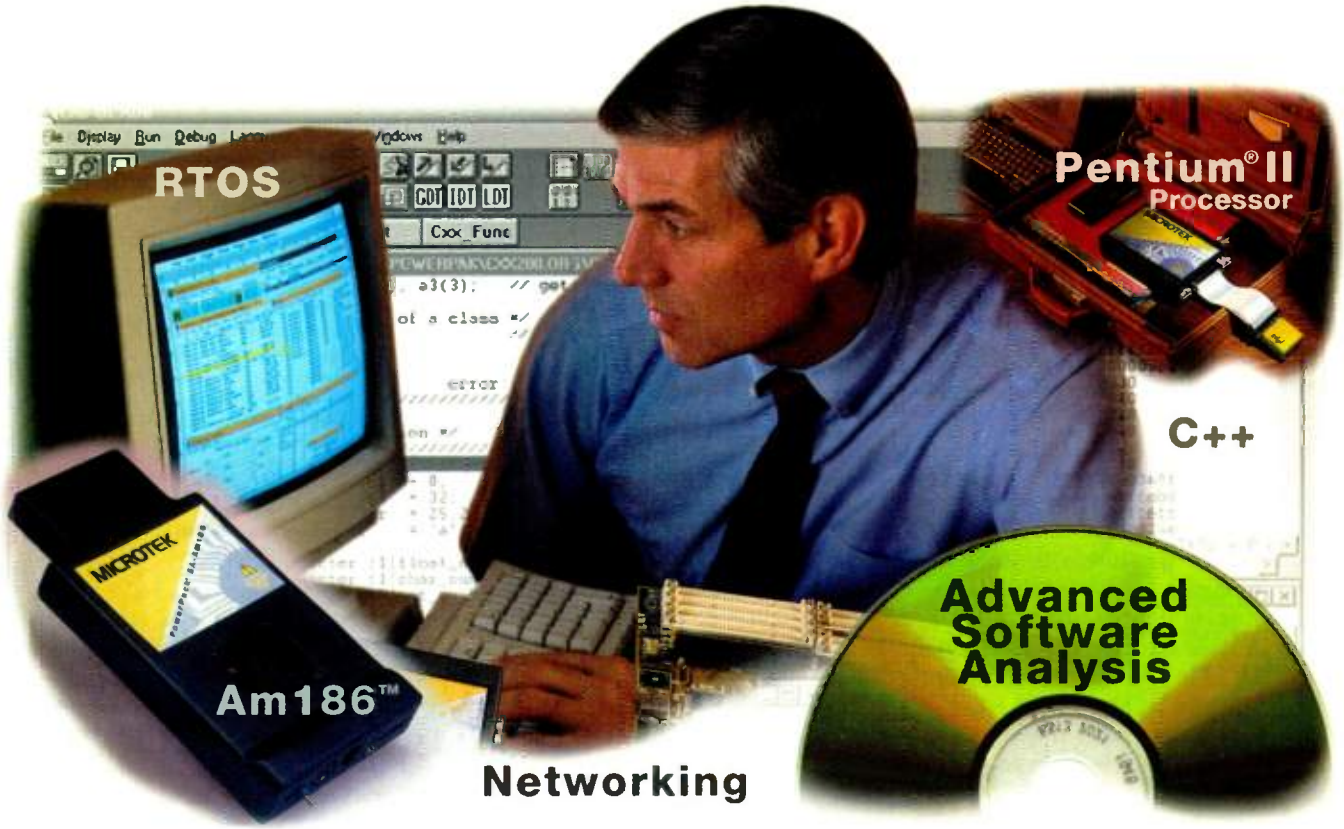

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World Radio History

TRUDEL TO FORM

Doesn't the need to couple new products with corporate strategy infer that product development is a corporate responsibility, not just an engineering issue? I think so. The trick is to develop a continuous flow of compelling new products while using innovation to renew corporate growth and profitability.

Where to start? It depends. New product development excellence is a journey, not a destination. Any trip depends on preferences and capabilities. Where do you want to go? What abilities and limitations do you have? Where are you starting from? I need to know these things, and more, before I can offer useful advice.

Also, successful innovation depends more on leadership than management. Pulling up the flowers to inspect their growth is not helpful. In general, "less is more." When top management tries to micromanage innovation, it usually makes things worse. Support is needed, not control and fear.

Question: "How many psychologists does it take to change a light bulb?" Answer: "Only one, but it must want to change." I'm not optimistic about a company's ability to change from the bottom up. I've worked in high tech all my life, and had my consulting practice for a decade. I've NEVER seen a company do consistently well at commercial products unless top management *really* wanted to solve that problem.

I'm a national judge for the Product Development Management Association's Outstanding Corporate Innovator (OCI) award. We select candidates from firms with superior business results. Every firm we've examined is different. Still, I've never seen a finalist whose top management did not view new product success as crucial.

My most successful consulting engagements tend to be personal and custom. I'm convinced that interventions, carefully focused to help managers improve business success, add more value for my clients. (A strategic choice. Standard solutions are much more popular—reengineering, for example.)

I start my engagements by asking questions, not offering solutions. A good question to ask is, "What problem are you trying to solve?" Sometimes the answers surprise you.

Once I was retained by the president of a larger consulting firm. They were competent, but stumped. That should have been a warning. Their client had a large defense plant in southern California. The need for the products that plant produced was going away.

JOHN D. TRUDEL

The assignment was to find commercial markets for the plant's exotic, expensive technology. We looked at dozens of markets, several technologies, and numerous methods of financing the total rebuild of this division.

It didn't look promising, but fate intervened. California had a major earthquake. The epicenter was almost under our client's plant. It leveled the place!

The real problem turned out to be the special economic considerations our client received for building in a distressed area and hiring locally. They'd have faced severe penalties for voluntarily closing the plant or shifting the workforce.

We'd certainly solved that problem! Our client was delighted. Still, not being able to count on timely earthquakes, I resolved to ask more questions before I took assignments.

John D. Trudel, CMC, provides business innovation consulting to selected clients. Lectures, keynotes, and workshops also are available. He is the author of "Engines of Prosperity." The Trudel Group, 33470 Chinook Pl., Scappoose, OR 97056; (503) 638-8644; fax (503) 543-6361; e-mail: jtrudel@gstis.net; Internet: www.trudelgroup.com.

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World Radio History

HOT PC PRODUCTS

Looking for great sound? Well, if a dozen editors' choice awards are to be believed, the next great thing might be the A3D-enhanced sound cards. Based on the Vortex AU8820 audio processor from Aureal Semiconductor Inc., Fremont, Calif., these sound cards even bring prizes to video games and desktop computers.

Originally developed for NASA, the purpose of A3D was to create realistic audio simulation during astronaut training. After being implemented in Aureal's Vortex chip, A3D worked its way into a variety of PCI sound cards. Using only two speakers or a pair of headphones, the A3D positional audio permits PC sound cards to produce a true 3D sound field for the listener.

This technology grew out of the fact that people hear sounds three dimensionally, but use only two ears. According to Aureal, it follows that the same effect could be replicated using two speakers. Aureal 3D recreates the hearing cues that permit people to perceive sounds in the real world. The speakers surround the individual with sounds in all three dimensions.

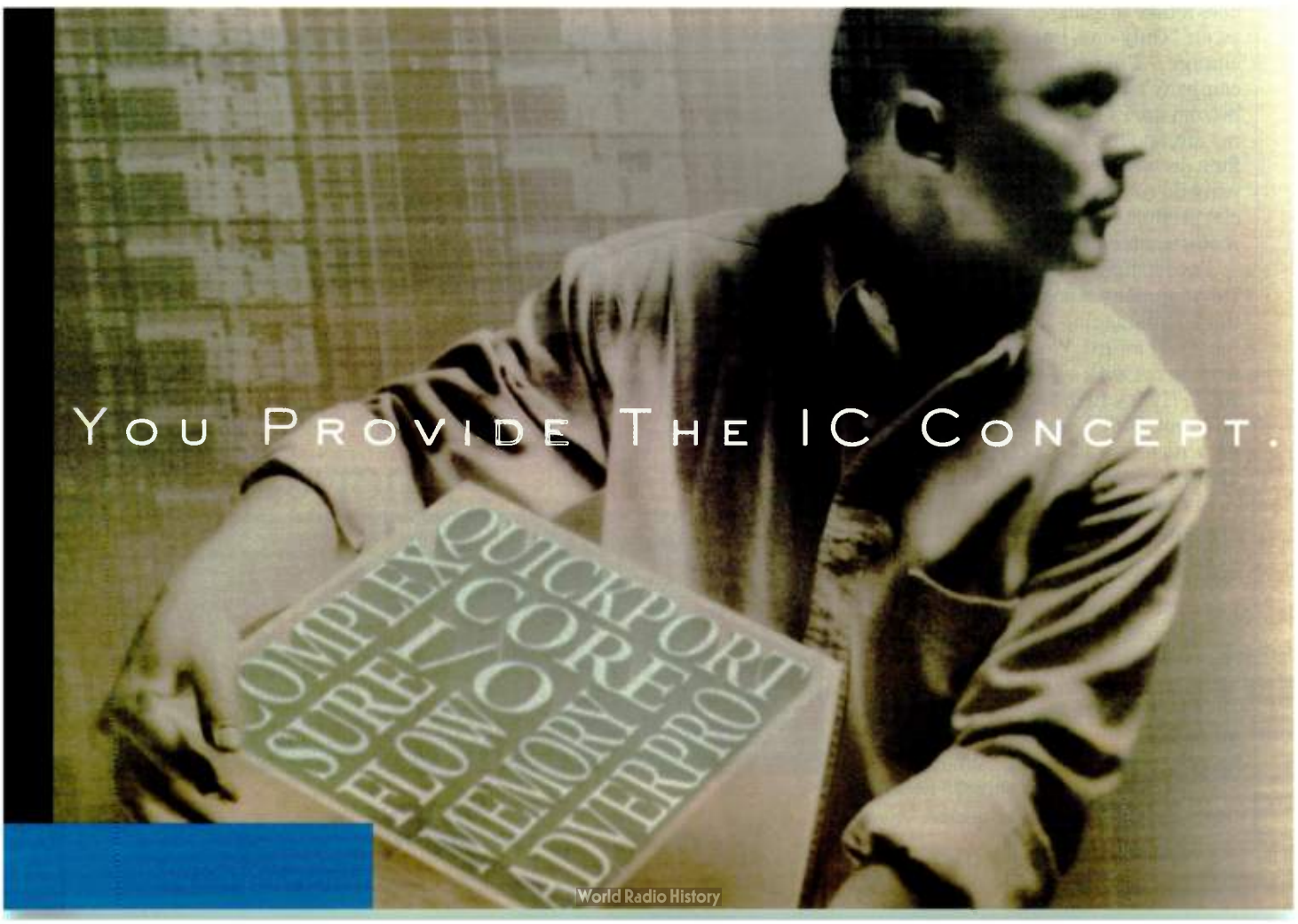
To bring this sound to PCs, the Aureal 3D utilizes the Vortex AU8820, which delivers more than 300 MIPS of digital processing over the PCI bus. In this process, the digital processing is already optimized for high-quality audio. The host CPU joins the Vortex AU8820 with its MMX-based software, performing the hardware resource allocation and control functions.

The final product is a sound card that provides a realistically perceived sound experience. To check it out, look to over 200 games on the Microsoft Windows platform, such as the Jedi Knight from LucasArts and Freespace from Interplay. Or, find A3D on the Internet, where it's now providing major VRML browsers with lifelike sound. In the PC market, Compaq and Dell now include A3D in some products.

Aureal has also shaken hands with Diamond, agreeing on a broad strategic partnership in which Diamond uses Aureal Vortex chips exclusively in its retail line. It probably didn't take much persuasion, considering that Diamond recently received several awards for its A3D-based Monster Sound Cards.

Vortex was under development for two years before its release. It enables better quality and features, but maintains support of existing DOS legacy audio functions. It can also interface to existing ISA telephony/modem solutions, so OEMs don't have to use an ISA bus. By delivering features like positional 3D audio, pro-quality wavetable music synthesis, and DirectSound acceleration, Vortex should lift PC audio up to another level of quality.

For more information, contact Aureal Semiconductor, 4245 Technology Dr., Fremont, CA 94538; (510) 252-4245; fax (510) 252-4400; e-mail: www.aureal.com.—NK



SCAMP-ering Along The Arctic Ocean's Floor

I'm sure most of us have heard about the potential mysteries of the deep. The Earth's oceans are so vast that no one knows exactly what they might contain. Giant squids, Loch Ness monsters, proof of Atlantis...the myths and speculations go on and on.

Though these mystical creatures and things remain largely a mystery, the seafloor of the Arctic doesn't have to be...especially since the Columbia Earth Institute got involved. Researchers there have created a new sonar system, known as the Seafloor Characterization and Mapping Pods (SCAMP), in an effort to reveal the geography of the Arctic Ocean.

SCAMP consists of two sonar mapping systems. One of these, a swath mapping system, measures seafloor depths. From each side of a submarine, it gages the seafloor depths out to about six miles on each side. Linking together these measurements creates a map of the ocean floor.

The swath mapping system also collects backscatter data. By revealing aspects like lava flows, this data elucidates the texture of the seafloor. The other mapping system being utilized is a sub-bottom profiling system. It complements the swath mapping system by identifying and outlining structures as far as 100 meters below the seafloor.

The SCAMP sonars work by being mounted on the bottom of a U.S. Navy nuclear-powered submarine—in this case the USS Hawkbill. According to Dale Chayes, a Columbia engineer, the submarine has the capacity to get further under the ice more quickly than an icebreaker. Combined with its stability and quietness, it seems that acquiring high-quality sonar data of the ocean floor will indeed be possible.

The resulting data will be used by geophysicists to create 3D images of the seafloor. Scientists will then be able to visually study some of its features. One example, the Gakkel Ridge, lies between the North American and Eurasian tectonic plates. There, a spreading center is creating a new seafloor. The new data may help explain the formation of the oceanic crust and the way that magma is brought to the surface.

The Gakkel Ridge is just one part of the Arctic Ocean that scientists don't understand. For reasons that haven't been discovered, the Arctic also has a great effect on the Earth's climate. Water samples also will be taken to gain some understanding of these issues and the Arctic Ocean's circulation. As the SCAMP rides the Hawkbill through this 75-day trek, scientists say it will collect as much data as a lawnmower cuts grass. Hopefully, no weeds will obscure the big picture.

To find out more about SCAMP, contact Columbia University, 2690 Broadway, New York, NY 10027-6902; (212) 854-1754; www.columbia.edu.—**NK**

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READER SERVICE 110

World Radio History

Implantable Medical Devices Are Mall Proof, So Keep On Shopping

Implantable medical devices and pacemakers grant people more independence. They are, to some extent, free to move around and live a normal life—while being treated. Because these devices are so successful, research and development is being dedicated to new implantable devices, such as nerve stimulators and insulin pumps. Amidst all the applause for these inventions, however, few hear about their potential complications.

Evolution has made these components smaller and smarter, leading to better pacemakers, implantable defibrillators, and other such devices. But, cultural changes also have prompted the development of the electronics encountered every day. For example, almost every retail store is now protected by an electronic article surveillance (EAS) system. While operating, these systems generate fields of electromagnetic energy. The problem? These electromagnetic fields can possibly affect the operation of these sensitive, electronic medical devices.

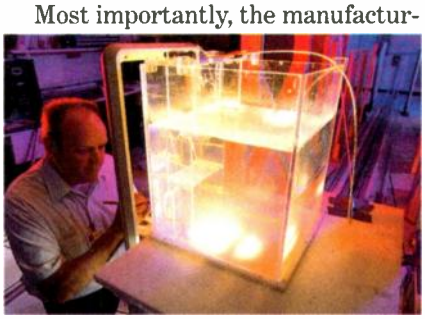
This is where the Georgia Tech Research Institute (GTRI) steps in. Researchers there are doing tests to make sure that individuals using implantable defibrillators or pacemakers can safely walk into a store. The manufacturers of these devices are helping to conduct the research. By donating their actual devices, they assist researchers in testing their specific equipment for possible interactions between the electromagnetic fields and the electronic components. The hope is that if the interactions are understood through research, they can then be prevented.

The research is a direct result of the cooperation between both sets of manufacturers: the makers of the energy source and those that produce the medical devices. Testing is done at the EAS/Medical Device E3 Test Center, which is supported by the International Electronic Article Surveillance Manufacturers Association (IEASMA). This association estimates that there are about 400,000 EAS systems in use worldwide.

Of these, the most common systems are those that are placed near a store's entrance and exit. By using electromagnetic energy, the EAS system can detect tags that have been attached to the store's products. The test center has eight EAS systems, as well as two EAS system tag deactivators, which were provided by the manufacturers.

Jimmy Woody, GTRI senior research engineer and manager of the test center, and Ralph Herkert, research engineer, activate the EAS products for their research. They then subject devices like pacemakers and defibrillators to the EAS systems' energy fields. With standardized testing procedures, they can discern the medical devices' responses in every range of operation. The data that results is sent back to the manufacturers' design and quality assurance departments. That way, they can improve their products based on the information.

Most importantly, the manufacturers gain the assurance that interference will not affect the medical devices. No harm, therefore, will come to the person using the medical device if they go somewhere where there's an EAS system.



The testing process itself is quite interesting. The medical devices are submerged in a tank of saline solution. This works to simulate the electromagnetic behavior of a human torso. The tank, with the medical device inside, is then moved through a merchandise control system. By using a computer-controlled positioner, the tank is moved in a way that imitates customers walking through these systems in stores. There's even a simulation of customers standing in line, within the vicinity of EAS equipment used to deactivate the anti-theft tags.

According to the researchers, the devices come through the tests with flying colors. They've been designed to handle interference. Any response to an electromagnetic field that's been measured during testing is subtle, according to Woody. For example, pulse rates suffer temporary changes or beats are missed. But, the devices always get back on track right away.

The devices recover normal operation as soon as they are moved out of the vicinity of the electromagnetic field, or if the field is turned off. In addition, the devices revert to the exact operational mode that they were in before testing. So, even if there is slight interference, no skewing of the rate of treatment will occur.

From an outside standpoint, it seems that these devices really should be made foolproof as far as interference is concerned. But in this instance, the medical devices' strength is also their weakness. The most recent pacemakers and implantable defibrillators work by sensing the body's heartbeat. In this way, it can respond to the specific needs of the heart. Upon detection of an abnormal rhythm, they send out electrical pulses which regulate the heartbeat. The heartbeat is thus prompted to return to normal.

The problem lies in the fact that electronic equipment, such as the EAS systems, also generate signals. These signals can be very similar to those of the heart. According to Woody, the electromagnetic field or its modulation can imitate a heartbeat. If it does, a pacemaker or another medical device could detect the signal and become confused.

Manufacturers have invented several ways of dealing with this issue. Filters included in the devices keep out most external signals. There's also a "noise" mode, used when the device is receiving confusing signals. It shifts the device to a generic heart rate and pace until the interference goes away.

Woody says the devices have come a long way, because an electromagnetic field could make a device stop pulsing 30 years ago. The researchers have also tested the effects of microwave ovens, cell phones, electric power equipment, radar systems, and radio broadcasts. So far, these devices are surviving the wireless age just fine.

To find out more about medical device testing, contact the Georgia Tech Research Institute, Georgia Institute of Technology, Atlanta, GA 30332-0800; (404) 894-3411; fax (404) 894-9875; e-mail: www.gtri.gatech.edu.

—NK

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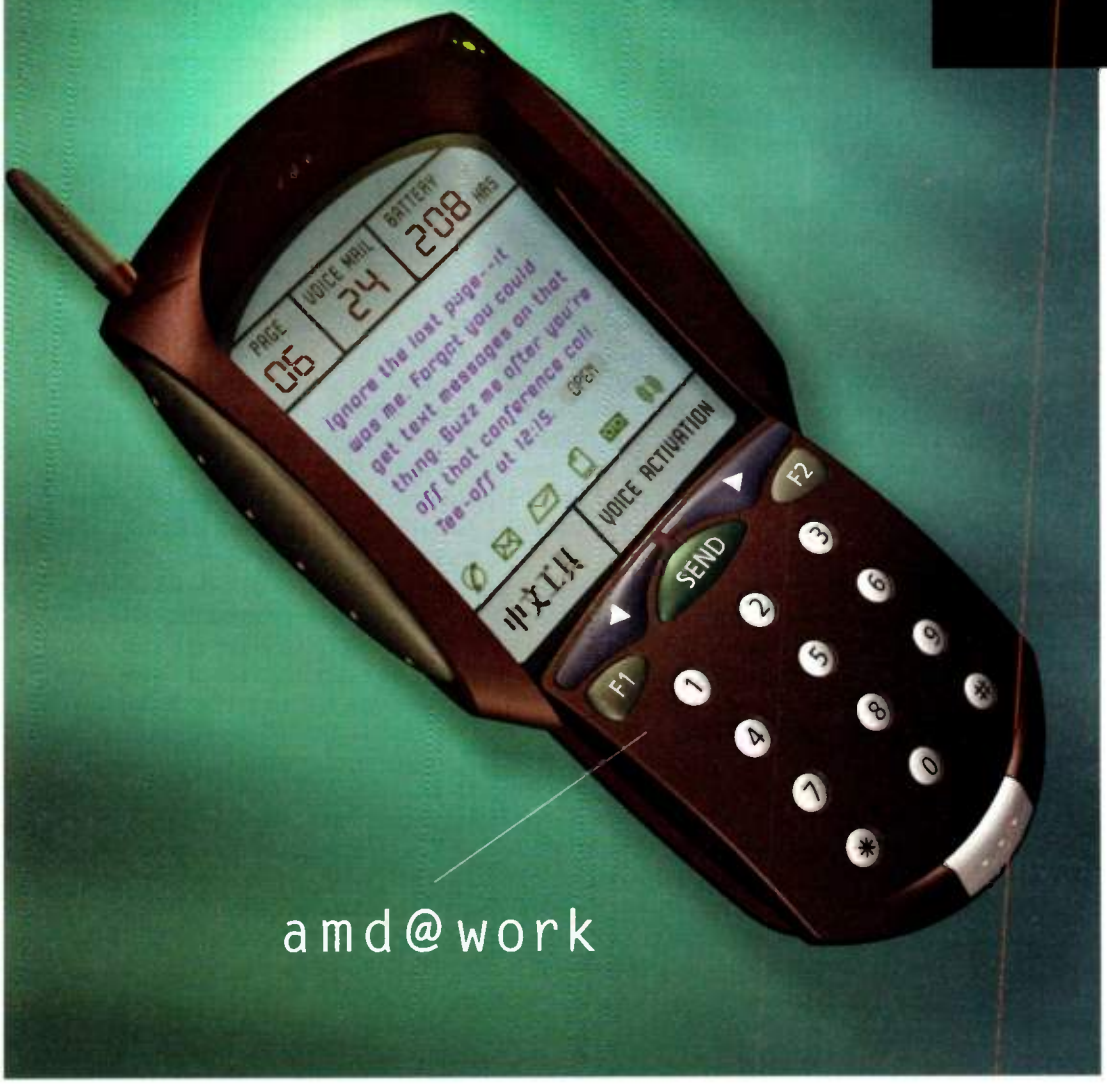

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JUST 4 THE KIDS

Computer technology traditionally brings disparate groups of people closer together. To remain competitive in this global market, it's increasingly necessary for many adults to learn to speak, read, and write different languages. Those of us with children know that when they're young, their minds are like sponges—eager to soak up any new information. It would benefit our children if we would take advantage of this willingness to learn and teach them other languages.

Thanks to a new series of CD-ROMs, called Kidspeak, we may now have a quick and easy way to do this. The basic technology for Kidspeak was developed by the Australian-based Smarty Pants Publishing. Transparent Language, Hollis, N.H., modified it to make it reflect the needs of the American consumer. Focusing on the fact that younger children are apt to learn new languages faster, the Kidspeak series of foreign language titles is specifically intended for children ages six to 12.

Kidspeak offers 11 language titles from which to choose: Spanish, French, German, Italian, Portuguese, Hebrew, Japanese, Mandarin Chinese, Korean, Indonesian, and English. Through the immersion method, the CD-ROMs engage the child in learning.

The child is directed by an animated talking friend and his or her pet. This friend, speaking only the target language, is the guide for more than 40 games, songs, and other fun learning exercises. Each Kidspeak language CD-ROM features a different friend. Titles include Pepa Teaches Spanish, Claudine Teaches French, Pip Teaches German, Mike Teaches English, Michio Teaches Japanese, Budi Teaches Indonesian, and so on.

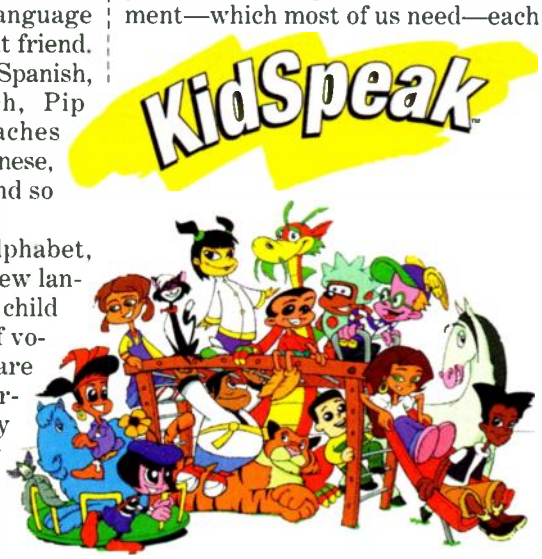
The basics, such as the alphabet, numbers, and songs of the new language, are taught first. The child then advances to a variety of vocabulary words. Activities are divided into five learning areas: Play with Numbers, Play with the Alphabet, Play Happy Birthday, Play with the Animals, and Play with the Backpack. Five activities comprise each learning area. For example, the Play with Numbers learning area is divided into Play Bingo, Add and Subtract, Connect the Dot, Sing the Number Song, and Play Dominoes. In addition, each of these activities have three levels of difficulty so the child learns at his or her own pace.

MARIFRANCES WILLIAMS

Kidspeak CD-ROMs educate in both written and spoken languages, while teaching simple math skills, computer literacy, and problem solving. They focus on specific skills, including correct pronunciation, word recognition, simple sentence structure, plural and singular forms, basic addition and subtraction, and over 700 key words and phrases. Each language program uses the voices of native speakers and features an illustrated, online audio dictionary.

Kidspeak comes with the Language Series Parent's Guide, which provides tips and ideas to assist the child's learning. It even offers an English language help screen. This is a big help to parents who don't speak the language the child's learning, especially if they're concerned about being faced with questions.

Kidspeak also contains printed activities and exercises to extend the learning experience beyond the computer. And, for positive reinforcement—which most of us need—each language program awards an official Kidspeak Diploma and a free Kidspeak T-shirt when the program's completed.



Language is an integral part of our lives. It ties us together, both personally and professionally. The Kidspeak language-teaching tool offers a user-friendly, fun, interactive way to jumpstart a child as he or she learns to communicate effectively. Best of all, the child is immersed in a playful and friendly foreign language environment. This appeals directly to the child's innate ability to acquire language. The games, activities, great sound effects, and colorful animation make the learning natural.

If you want to brush up on your skills or learn a new language, Transparent Language offers a foreign language program for adults, called 31 Languages of the World. Its innovative, three-step process keeps learning both engaging and enjoyable. The program even includes practice conversations with native dialogues. Other CD-ROM's available from Transparent Language are Language Now!, WordAce!, Talking Translation Dictionary, and Easy Translator.

Kidspeak CD-ROM is now available at retailers. It costs approximately $19.95 for individual language programs, or $39.95 for the ten-in-one multilanguage package. The 31 Languages of the World sells for $39.95. Transparent Language's other programs are in the same price range.

For more information, contact Transparent Language Inc., 22 Proctor Hill Rd., P.O. Box 575, Hollis, NH 03049; (603) 465-2230; www.transparent.com.

Marifrances D. Williams holds a degree in Liberal Studies from San Diego State University, Calif. She is currently a fifth-grade teacher at Los Ranchos Elementary, San Luis Obispo, Calif. Williams specializes in the identification of advanced technology for the use of child-focused applications. She may be reached at williamsofsm@lightspeed.net.

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World Radio History

KMET'S CORNER

RON KMETOVICZ

Parents, or those headed in that direction, please read this column. I provide insight on raising your child to become an engineer.

During the past few weeks I've found myself speeding down memory lane. My father's death in late March launched these trips. I've gone in many directions, but keep returning to one primary topic: my childhood and formative years with Dad. And, of all things considered, my father laid the foundation for my becoming an engineer.

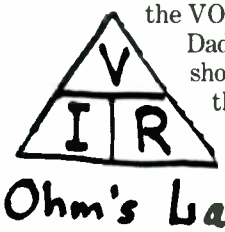
I honestly cannot remember when I started using hand tools. A hammer, screwdriver, wrench, and pliers extended from my body. These were no kid's tools, they were the genuine articles. I'm sure I played with each of them, but more important, I'd imitate what Dad did.

On those projects where I might harm myself or the work that needed doing, he set me up, assisting on the side, doing busy work. With my age still in the single digits, I became quite skilled using simple hand tools. And remarkably, the smashed fingers that were cut and bruised in the process of learning retained not a single scar or deformity.

Also, while still under the age of 10, after learning how to add, subtract, multiply, and divide (but way before I knew the concept of an equation or algebra), I learned Ohm's Law. Dad provided me with the illustration here on a sheet of paper. He told me it was Ohm's Law, and I accepted it.

He showed me how to use it with a battery, volt-ohm meter (VOM), and a light bulb. We measured the V of the battery, and the R of the light bulb. He then told me that once I knew two of the three items, I could use math to figure out the third by following the picture. In this case, because I knew V and R, I needed to divide R into V to calculate I.

After doing the long division, he showed me how to measure I with the VOM to check my work.



Ohm's Law

Dad's passing made it necessary for me to handle the "stuff" in his shop. This activity really woke me up! His shop changed very little over the years, but since leaving for college 33 years ago, I've had no need to use it.

The sensation was strange. I resided in the shop in the present, but saw a kid and his dad working with the tools and instruments as I handled many of the items. I became reacquainted with the oscilloscope, RLC meter, audio oscillator, and sweep generator.

I remembered the instructions Dad provided on the use of these instruments, and the atmosphere of learning by destruction he tolerated. Oh how nice it would be to blow-up a few capacitors once again! My dad made messing around with electronics interesting and fun.

He even made it possible for me to win a science fair competition with a Tesla coil he helped me build. We finished this project two years before blowing up the garage on our final science project!

So parents, follow my dad's example. Introduce your child to tools early in life, spend time teaching by doing. Then teach your child the art of instrumentation. You'll have to spend money on the basic items such as a VOM and oscilloscope. And, most important, give of your knowledge and time in an unselfish manner as you watch your child attempt to destroy the world you've created.

Ron Kmetovicz, president of Time To Market Associates, is the author of "New Product Development, Design and Analysis." He helps new product development teams deliver profitable products to the market quickly. He can be reached at: P. O. Box 1070, 100 Prickly Pear Rd., Verdi, NV 89439; (702) 345-1455; fax (702) 345-0804; e-mail: kmetovicz@aol.com.

INTERNET NEWS

Here's a chance to try a new file expander and win a travel voucher, accessory bag, and software. All that's required is a trip to Aladdin's web site to download their new Aladdin Expander version 2.0 for Windows.

Geared toward online users, this freeware product was created to make expanding files easier. Able to work with all popular compressed and encoded files, it's supposed to make downloading from the Internet or online services a breeze.

The Aladdin Expander 2.0 is also the first Windows decompression tool that can expand StuffIt-compressed files. Because StuffIt's usually used for decompression on the Macintosh, Windows and Mac users can finally exchange files—despite access or platform compatibility. It also permits users to connect StuffIt Deluxe's segmented archives for the Macintosh. Those big Mac files, divided into smaller pieces for manageability, can now be put back together in Windows.

For convenience, the Expander supports long file names and 32-bit operation. And, if a user upgrades their operating system, the Expander's universal decompression adapts to the new features. Since it works with most file formats—such as Zip, UUencode, Binhex, and MacBinary, to name a few—access to files should never be a problem. It also expands self-extracting archives from StuffIt, Zip, and Arj.

For those privacy lovers out there, Private File decryption capabilities are included. Encrypted documents can be sent to other Private File users, as well as those who have installed Aladdin Expander. These documents travel safely over the Internet, where they cannot be decompressed and decrypted without the correct password.

To download the Aladdin Expander 2.0, just go to www.aladdinsys.com. For more information, contact Aladdin Systems Inc., 165 Westridge Dr., Watsonville, CA 95076; (831) 761-6200; fax (831) 761-6206.—**NK**

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