GaAs-ON-SILICON GOES COMMERCIAL/47

CHIPS & TECHNOLOGIES PLUGS INTO IBM'S PS/2 /75

PAGE 83 TECHNOLOGY OUTLOOK

OCTOBER 15, 1987 A McGRAW-HILL PUBLICATION SIX DOLLARS

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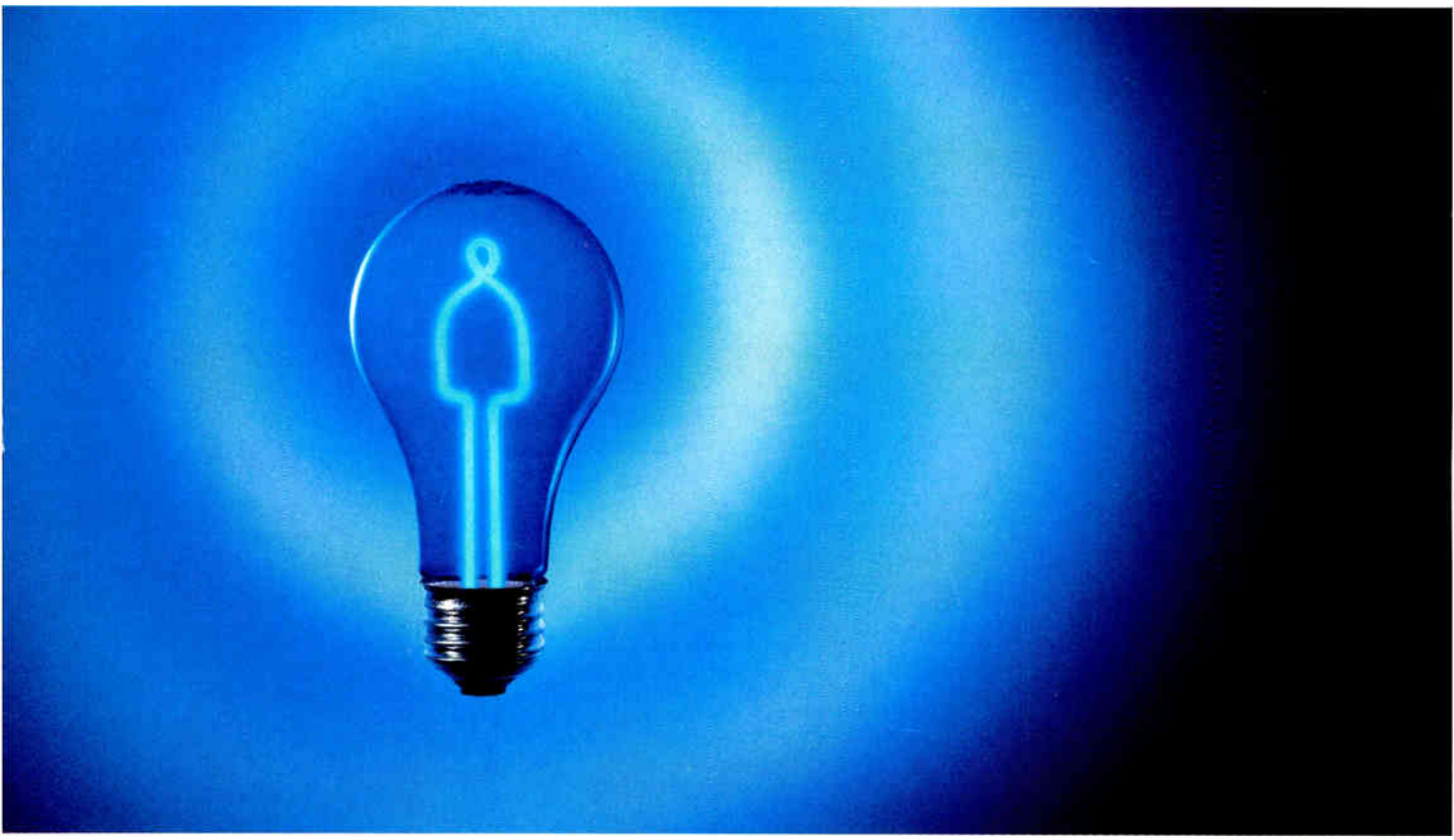
A BIG EUROPEAN PUSH AND AGREEMENT ON INTERFACES MOVE IT CLOSER TO A WORLDWIDE STANDARD

PAGE 67

LOOKING BETTER

Only Mentor Graphics has brought a billion gates to light.



In just 5 years, over a billion gates have flowed through our IDEA Series™ design automation systems. And that's a very conservative estimate.

Which makes it seem all the more incredible that, before we came along, almost all electronic circuits were drafted and breadboarded by hand.

Since then, our schematic capture and simulation tools have produced more circuits for more products than any other electronic design automation vendor. A claim only Mentor Graphics can make.

Along the way, we've pioneered schematic capture and simulation tools that are now industry standard. Like hierarchical design entry, which allows efficient management of even the largest designs. And MSPICE,™ which brings real interactivity and a graphics-oriented interface to analog simulation.

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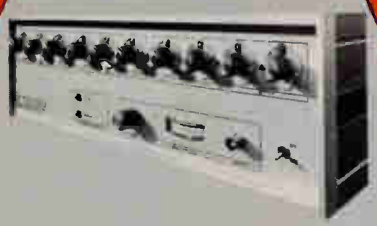

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For some, October means the real beginning of fall. For others, it's the start of the fourth quarter. But for us at *Electronics*, every October since 1974 has meant the season of the annual Technology Outlook.

Our yearly look at what's coming across the whole breadth of the electronic-technology spectrum—an effort that has been much imitated but never equaled—doesn't quite enlist a cast of thousands. But it does require the work of nearly all of the people listed on our masthead. They have spent a lot of time and energy in recent weeks reporting the progress, pulling together the trends, and interpreting the portents in the electronics industry even as they attend to their regular duties in preparing the rest of the issue.

WEBER: Technology is changing faster and faster.

Under the direction of executive technical editor Sam Weber, this 14th annual report, beginning on p. 83, reflects the overarching need that drives technology: more information.

"In every area, from chips to computers to telecommunications, we're seeing faster and more powerful processors, bigger memories, more efficient computer architectures, and more commodious networks," says Sam. And *Electronics* is helping to bring its readers, the people who must satisfy the universal thirst for information, more information that is carefully selected to help them do their jobs.

One way that we carry out that mission is our diligence over the years in keeping step with the ebb and flow of the technological tides. Just consider the changes in the way we divided the technologies between the Technology Update, as it was then called, of 13 years ago and this year's Technology Outlook.

In 1974, we covered seven specialties: computers, communications, instruments, industrial electronics, consumer electronics, solid state, and components. Now, the count is 12: what was computers in 1974 has split into that category plus software, CAD/CAE, and data communications. Communications is now telecommunications, the former industrial electronics has evolved into factory automation, and we have added chip processing, packaging, and test and measurement. And solid state is now semiconductors and microprocessors. Consumer electronics is the only category untouched.

Another difference is in the choices facing the equipment designer. In 1974, they were more basic than they are now: the engineer had to decide whether to use bipolar or MOS, microprocessors or minicomputers, hard-wired controls or programmable computers. That was pretty much the extent it. But one thing hasn't changed. As we wrote 13 years ago, "For a technology to succeed, the cost must be right, and above all, the timing must be right."

There also has been a quantum change in the pace of innovation over the years. Talking about this year's effort, Sam sums it up this way: "Developments on the technology front move a lot faster now than they did a decade ago. Our editors must not only pick up trends, but they must also be fast on their feet. It is impossible to relax one's guard for a minute."

Laurence Altman

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OCTOBER 15, 1987

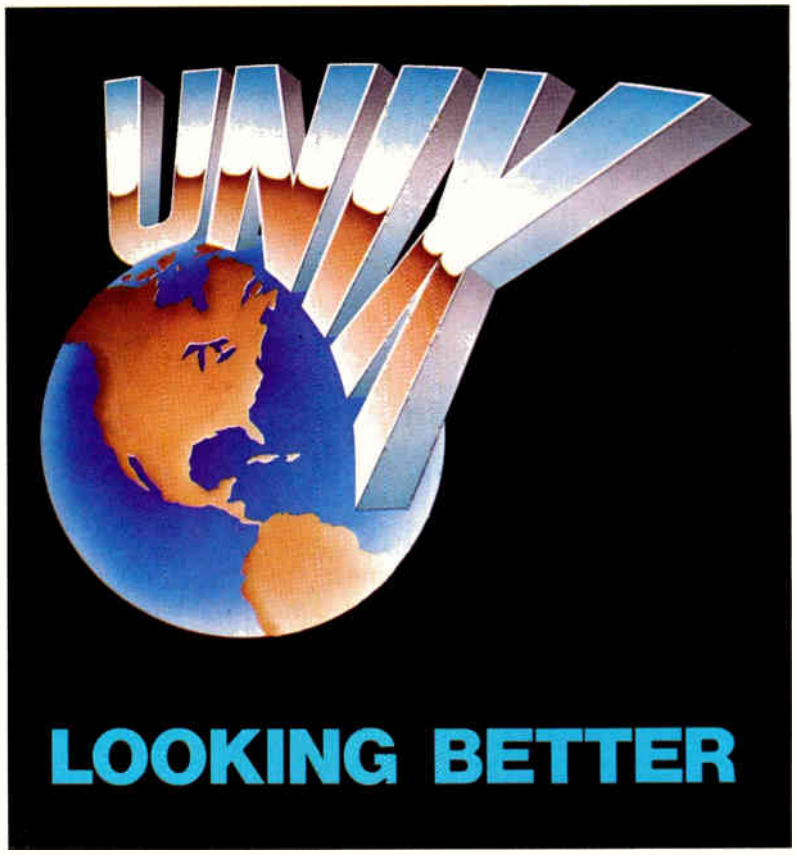
Electronics

NEWS

INSIDE TECHNOLOGY

PROBING THE NEWS

COVER: DAVID MYERS



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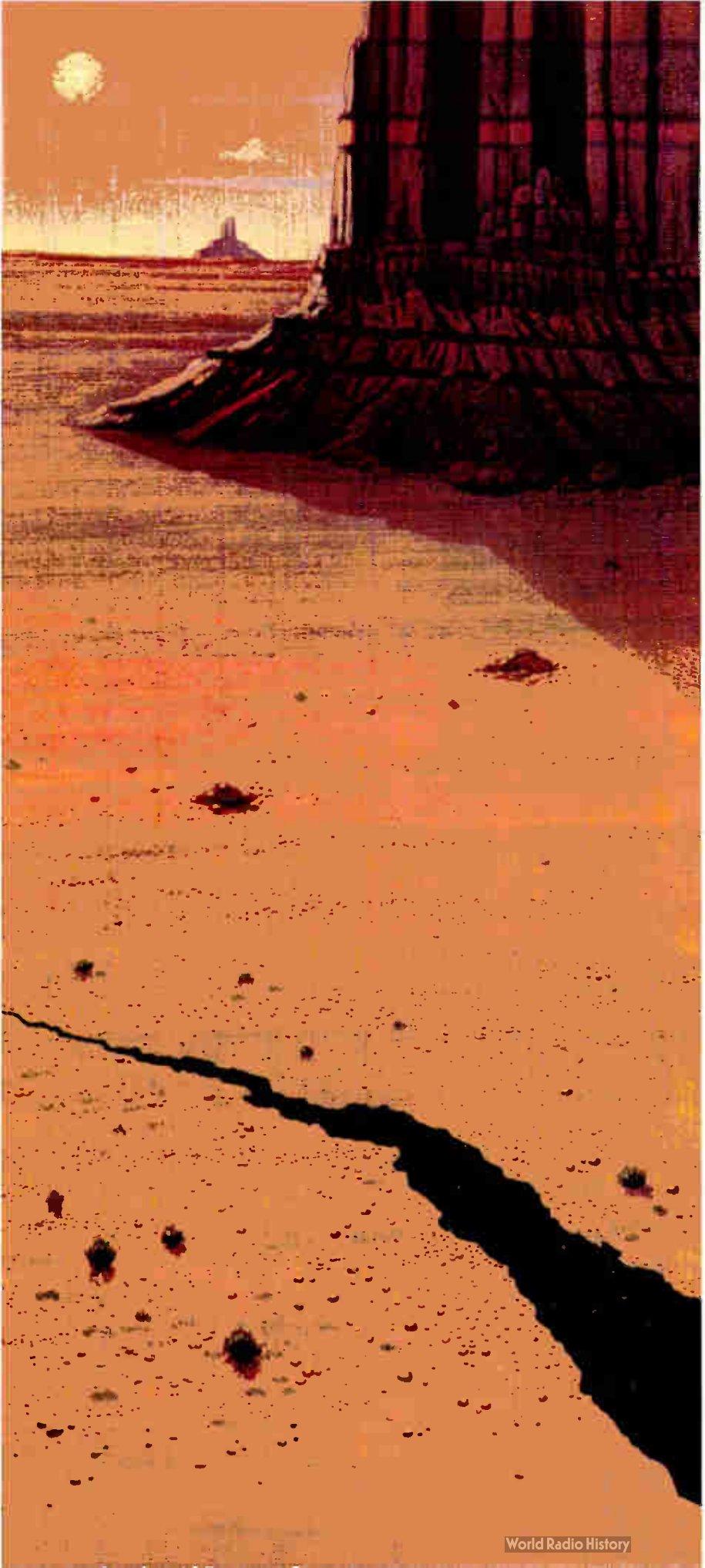
NEW PRODUCTS

Newsletter, 25
- Western Digital launches a barrage of PS/2 clone chips and boards
- 10-Mbyte 3½-in. floppy-disk drive from Brier Technology runs as fast as a Winchester
- NeuralWare's software package helps engineers to design neural networks
- Altera's EPLD chip builds custom peripheral functions quickly

Computers & Peripherals, 151
- Control Systems' Hostess series of adapter boards link IBM Corp.'s PS/2 to 32 dumb terminals
- CDC's 3.5-in. disk drives feature 200-Mbyte capacity
- Clock-calendar from Time Source eliminates data loss on computer networks
- Concurrent Technologies' Multibus II board attains data rates of 32 Mbytes/s
- Color graphics board from RasterOps more than doubles resolution of Macintosh II

Military/Aerospace Newsletter, 147
- Air Force to try amorphous-silicon, active-matrix LCD
- The growth in defense-electronics spending is leveling off, says the EIA
- Customs adds more radar balloons to spot drug smugglers
- From Thomson, a digital display map for French tactical aircraft
- VLSI Technology and Vitesse will meld silicon and GaAs design processes

DEPARTMENTS



Everything doesn't need to be your fault.

Designing a new system has enough risks. Why pass up an off-the-shelf sure thing like AMD's complete Ethernet chip set?

We designed the Am7990 Lance, Am7992B SIA, and the AM7996 Transceiver to work with one another. And what happened? They work with one another.

AMD can offer you something no one else can offer. Absolute confidence.

Our chip set has been around since the beginning of Ethernet. It's been proven by years of successful networking in systems. That means you won't be designing it in, then covering your tracks when it doesn't work. (And if you work with Cheapernet, you're still safe, because our chip set does, too.)

Look at it this way:

You're going to get blamed for a few things in life that are absolutely not your fault. Why not choose the AMD Ethernet chip set and pick up some easy praise?

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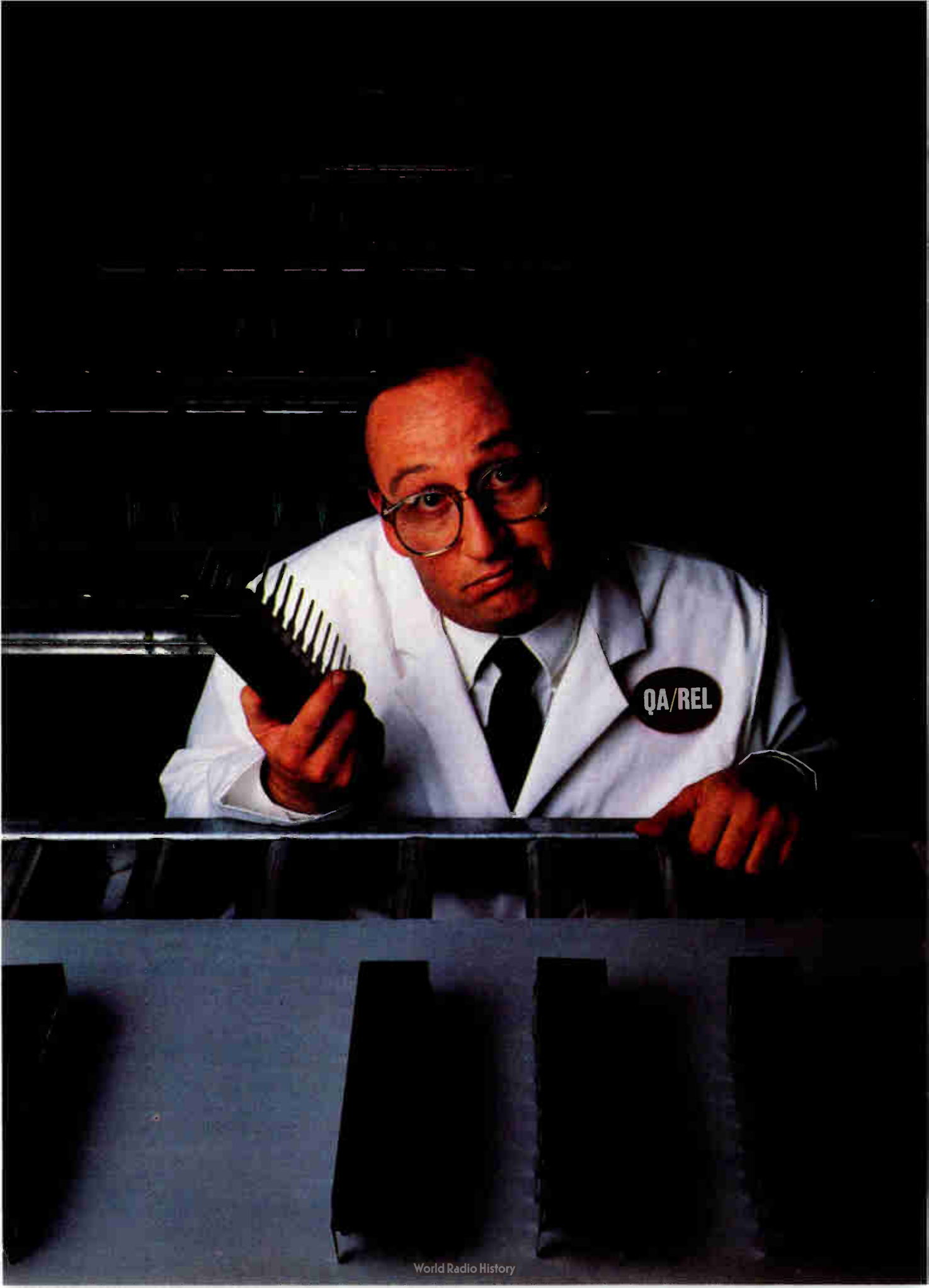

TIRED OF THE SAME OLD CHIP?

It's the same old story. Static RAM suppliers come out with new claims based on, what else, speed. But, with everybody touting speed, they all start looking alike. Until you look at reliability.

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At the transistor level, we use lightly doped drains to inhibit hot electron effects, yielding transistors that will last over a century.

And our manufacturing flow is managed by one of the most stringent Statistical Process Control systems in the industry. So you're assured of getting products that are consistent and reliability that is second-to-none.

Our 25ns, 64K static RAMs have set the standards for both speed and reliability. And these standards will be extended even further with our family of 256K static RAMs.

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Apple picked our brains.

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Before millions of people picked Macintosh,™ Apple® picked Motorola's M68000 Family—the brains behind one of the most successful computer products ever launched.

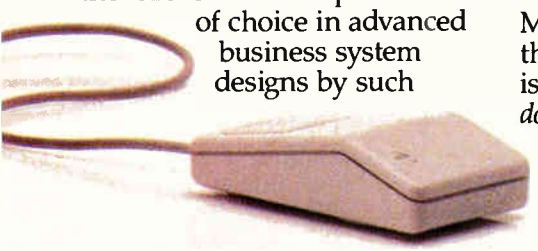
Now Apple has tapped the brainpower of the Motorola MC68020 microprocessor for the Macintosh II, bringing the high performance of a graphics workstation to business desktops everywhere.

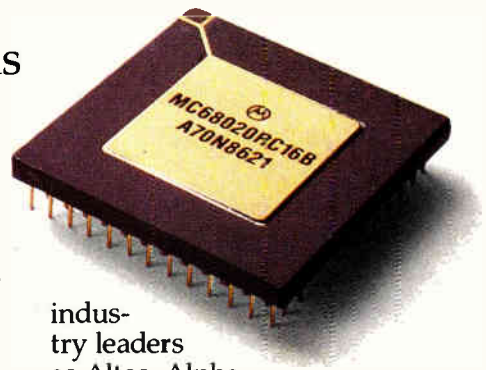
72% of all 32-bit systems ever shipped included at least one MC68020. That's more than half a million high-performance systems.

The high-performance business solution.

The MC68020 is not just the overwhelming choice in workstations—it is now setting new performance standards in the office—where it is essential to the computation, graphics and communication necessary for interconnected systems.

While Apple's choice of the MC68020 was a smart move, there's no license on genius: the '020 is the microprocessor of choice in advanced business system designs by such





industry leaders as Altos, Alpha Micro, Casio, C.Itoh, Fujitsu, Honeywell Bull, NEC, NCR, Olivetti, Plexus, Ricoh, Sanyo, Sharp, TI, Toshiba and UNISYS.

The graphics solution.

The M68000 family helped Apple implement the visionary "point and click" graphic workstyle that has driven productivity up while driving training costs way down. Businesses of all sizes are discovering dramatic productivity increases in office computing through innovations such as desktop publishing.

The software solution.

Among programmers and designers dedicated to creating the best, most innovative applications, the M68000 architecture has been the leading choice by far—with over *seven million M68000* systems installed since 1979.

Meanwhile, the MC68020, on the market now for three years, is already backed by *two billion dollars worth* of 32-bit software. This is more 32-bit software than all competitive products combined!

The Brain Trust: Where M68000 microprocessors predominate.

Engineering Workstations
Apollo, Hitachi, HP, Sony, Sun, Tektronix.
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Apple, Canon, HP, IBM, QMS, Ricoh.
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PBX and Telephone Systems
AT&T, Northern Telecom, Siemens.
Fault Tolerant Systems
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Supercomputers
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Challenge us to persuade you of the sound business and technical reasons to join the M68020 Brain Trust. Write to us at Motorola Semiconductor Products Inc., P.O. Box 20912, Phoenix, AZ 85036.

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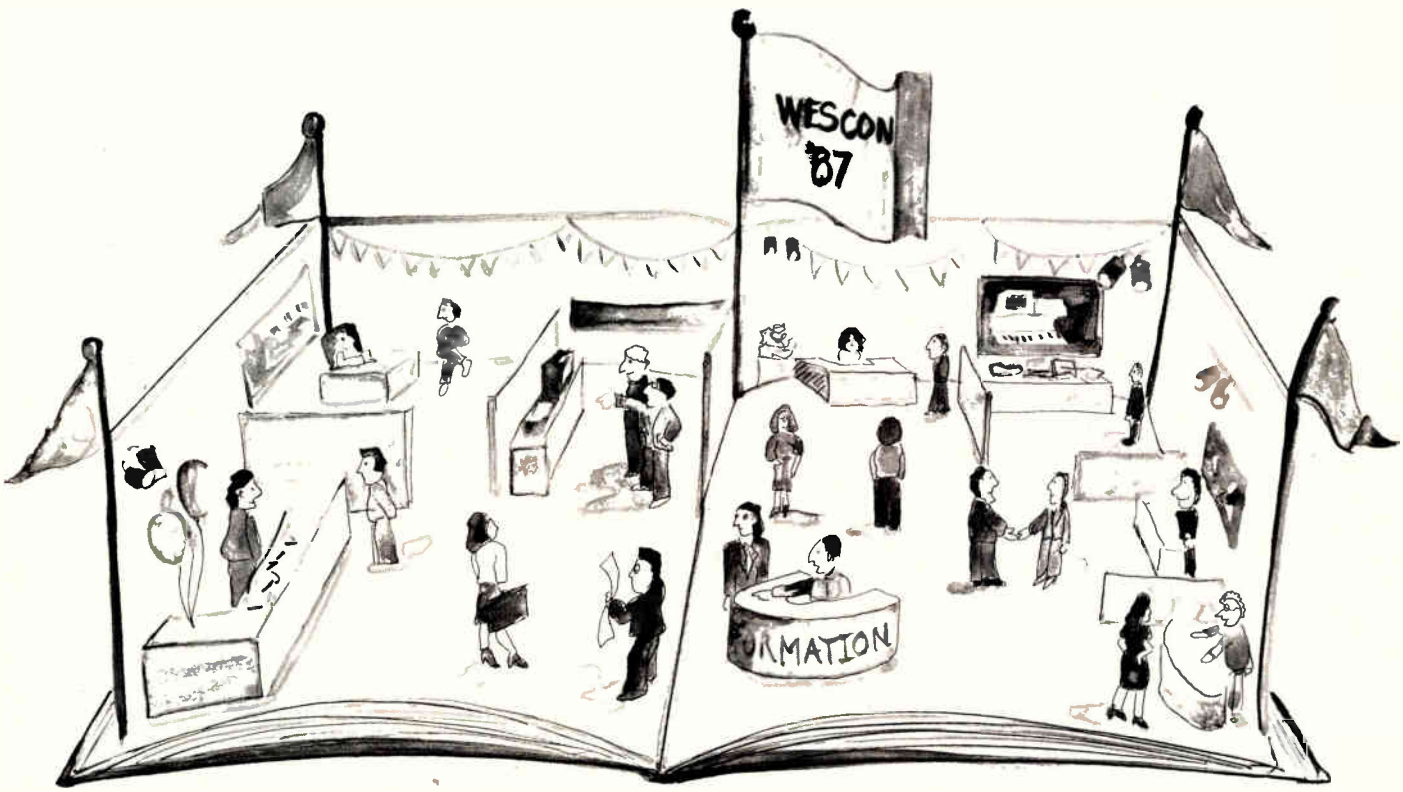
Catch Wescon '87 in Electronics



The November 12 issue of *Electronics* will be the Wescon '87 show in print.

Wescon, being held this year November 17th-19th in San Francisco, is the oldest and largest high technology electronics trade show in the U.S. And our editors are gearing up to provide the most comprehensive coverage available.

It's an issue that no one will want to miss for its insightful coverage of what's new, what's changing, and what to expect in semiconductors, computers, components, instrumentation, packaging, and much, much more.

It's *the* issue to read if you plan to be at the show and want to put all that's happening in perspective. As well as *the* issue to read if you can't be there and want an exclusive look at the most important products being introduced from among the more than 800 exhibitors.

If you're an advertiser exhibiting at the show, use this issue to direct our readers to your booth. And if you're not, you can still get in on the show action as more than 131,000 technical managers and senior engineers read and reread every page of our Wescon '87 show issue. So make sure they "catch" your ad.

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Electronics

ELECTRONICS NEWSLETTER

DRAM FIRMS WORRY BOOM MAY SPARK DOUBLE ORDERS AGAIN

Rising prices and orders for 256-Kbit dynamic random-access memories are bringing good times to recession-battered DRAM suppliers—but not without worry that panic buying is behind the recent upsurge. Warning of double and triple orders, John Marck, vice president and general manager of memories at NEC Electronics Inc. in Mountain View, Calif., says NEC's lead times will stretch out to May and June on new orders for 256-Kbit chips. In an effort to keep its lead times short, Texas Instruments Inc. is not taking on any new customers. "We are trying not to take orders past the first quarter," says Ramesh L. Gadwani, manager for TI's U. S. MOS Memory Division in Houston. That's kept TI's prices "stable for the last three months," he adds. But prices in general have not been stable. DRAM prices rose 10 cents a week in September, says one analyst, and prices for 256-Kbit parts could reach $3, up from less than $2 a year ago. The trend is likely to continue. NEC's Marck warns that the DRAM shortfall could reach 15% by January. □

NATIONAL INTEGRATES FAIRCHILD'S OPERATIONS WITH ITS OWN...

For National Semiconductor Corp., the hard part of its deal to buy Fairchild Semiconductor Corp. has only just begun. After signing the final agreements, delayed for a week to work out the details, National will face the monumental task of gluing the two companies together—a job it has given itself just a half year to complete. James M. Smaha, executive vice president of National's Semiconductor Group, says speed in completing the merger is essential to keeping Fairchild's top technologists and executives from defecting. Some key personnel have already quit, however, and worry is building as Fairchild's 9,000 employees anticipate layoffs. □

...AND FAIRCHILD'S CUSTOMERS RETURN TO THE FOLD

While executives at National Semiconductor Corp. worry about how to bring Fairchild into its fold, Fairchild product managers say customers are already responding positively to the merger. Clients who were unsure of Fairchild's future after Fujitsu Ltd.'s aborted attempt to purchase the company last winter are now beginning to commit to new products and technologies, especially Aspect, Fairchild's newest LSI emitter-coupled-logic bipolar process. Chip-buying computer houses were holding off committing to Aspect-based products while the fate of the company remained in limbo. Now "we are really encouraged," says Tom Miller, director of strategic marketing for Fairchild's custom and microprocessor unit. "Up until the first of September, we could not get anyone to commit [to Aspect]." But during that month, Fairchild won two customer commitments, and Miller says he is close to signing eight more in the next 60 days. □

NEW CONSORTIUM WILL FUND PRODUCTION-TECHNOLOGY RESEARCH

A new consortium of U. S. manufacturers seeking to improve their competitiveness in world markets is taking aim at control technology. The National Center for Manufacturing Sciences of Ann Arbor, Mich., was established to solve generic manufacturing problems that are too costly for its 225 member companies to finance individually. These include electronic controllers, sensor and control techniques, and test-and-evaluation methods. Edward Miller, the consortium's executive director, says the group will spend between $60 million and $100 million over the next three to five years on a project aimed at improving control technology, which is crucial to automated manufacturing. Miller says electronic controllers have not "evolved with other state-of-the-art technology." □

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For optimal packing density, our standard 64K SRAMs are delivered in the popular 0.3″ package widths, in either hermetic or plastic.

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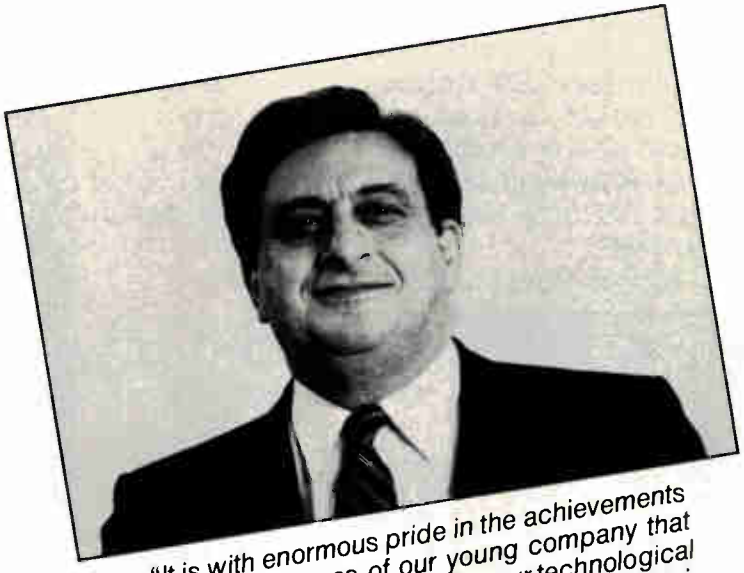

"It is with enormous pride in the achievements of the employees of our young company that we are able to announce that our technological pace is accelerating. Our engineers and scientists are smart, dedicated, and focused. New levels of technical productivity are being established every month. We are at the tip of the technology vector into the future and we intend to stay there."

Tom Longo
President

PERFORMANCE
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I want a faster system! Please send me detailed information on your SRAMs.

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PRODUCTS NEWSLETTER

WESTERN DIGITAL LAUNCHES BARRAGE OF PS/2 CLONE CHIPS AND BOARDS

Computer makers out after a piece of the six-month-old Personal System/2 market opened up by IBM Corp. can count on Western Digital Corp. for considerable help in cutting costs through drastically reduced components counts. Over the next five months, the Irvine, Calif., company will bring to market a family of 19 parts—including a single-chip implementation of the core logic for the PS/2 Models 25 and 30 and a four-chip set for Models 50 and 60. The FE2011 core-logic chip for Models 25 and 30 will be sampled starting in December and priced at $33 in 100-unit quantities; the FE5400 four-chip set will follow in January, priced at $99, also in lots of 100. The WD PS/2 family also includes the PVGA1 video graphics controller (available now, $60); the WD57C65 single-chip floppy-disk interface (available now, $6); and the WD16C552 single-chip dual-channel asynchronous communications unit (available in February, $12). Like Chips & Technologies (p. 75), Western also is offering adapter boards compatible with the IBM PS/2 Micro Channel bus found on the PS/2 Models 50, 60, and 80. □

10-MBYTE 3½-in. FLOPPY DRIVE RUNS AS FAST AS A WINCHESTER

A new company called Brier Technology Inc., San Jose, Calif., says it has developed a 3½-in. floppy-disk drive with the capacity and performance of Winchester drives. Previously, only the 5¼-in. floppy-disk drives from Iomega Corp., Roy, Utah, have attained the performance of a Winchester. The Brier product stores 10 Mbytes of data on a conventional disk and accesses in an average of 35 ms—comparable to the speed of 3½-in. Winchesters. Brier plans to show the drive at the 1987 Fall Comdex show to be held in Las Vegas Nov. 2-6. It contains a Small Computer Systems Interface within the 3½-in. form factor, for easy integration into existing systems. Brier expects to ship evaluation units in the second quarter of 1988; when production starts, OEM quantities will go for $400 to $500 each. □

SOFTWARE HELPS ENGINEER TO DESIGN A NEURAL NETWORK

An extensively documented software package called NeuralWorks Professional is designed to introduce engineers to neural computing and the design of neural networks for such applications as signal processing, filtering, image and pattern recognition, and fuzzy-logic expert systems. A graphical interface running on an IBM PC XT or AT lets the user develop a concept, then create, edit, train, test, and debug a network using one of eight major neural-network paradigms. The package is said to be simple enough to be used by someone with no experience in neural computing, yet sophisticated enough to solve complex problems. It sells for $495 and is available now from NeuralWare Inc., Sewickley, Pa. □

FAST 12-BIT TRACK-AND-HOLD AMPLIFIER RUNS ON 5-V SUPPLY

Speedy CMOS 12-bit analog-to-digital and digital-to-analog converters now have a companion fast track-and-hold amplifier that runs from the same ±5-V power supplies. Crystal Semiconductor Corp. of Austin, Texas, has a 12-bit self-calibrating track-and-hold, the CS3112, with fast acquisition times—1 μs to a 0.01% error level—and a typical aperture jitter of 100 ps. The CMOS part is aimed at an emerging analog signal-processing market, where the new CMOS converters are used but matching 5-V track-and-hold circuits cannot be found. Existing parts typically need 15-V supplies. Crystal's 1-μs chip is priced at $12.10 each in 100-piece lots, and a device rated for 2-μs operation at $8.90 each. The chip has a droop rate of only 0.001 μV/μs, which Crystal says beats the competition by a wide margin. □

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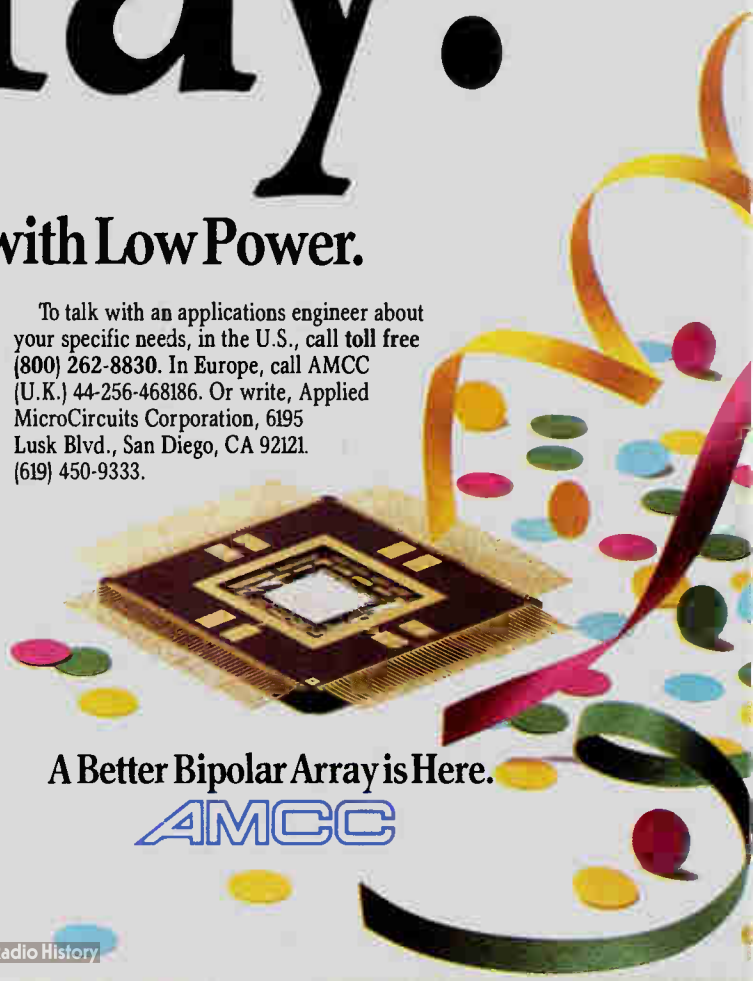

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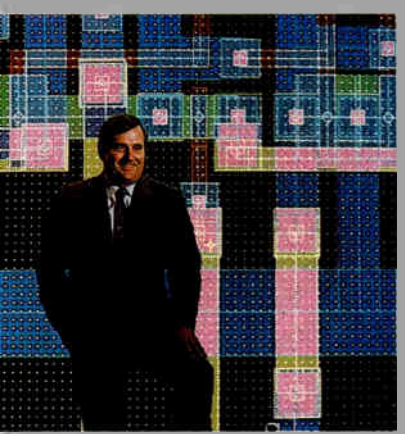
According to Mr. Hill, Digital's unmatched software compatibility offers real benefits in creating customer acceptance. "We know that whatever Digital system the customer has purchased, our software will run on it successfully. That kind of confidence is rare in the IC design industry. And Digital's hardware and



"ECAD seized an 80% world market share – the key was writing our design software to the industry standard, Digital."

software consistency helps us deliver a better product, faster and at a lower cost."

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digital™

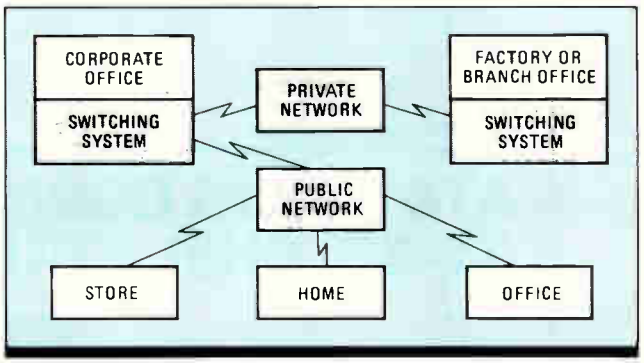
Electronics

THE SUN COMES OUT FOR DATA GENERAL

NTT PICKS MINI MAKER AS PARTNER TO DEVELOP INTEGRATED NETWORKS

WESTBORO, MASS.

There's good news at Data General Corp. for the first time in many a month. Japanese telecommunications giant Nippon Telegraph & Telephone Corp.'s selection of Data General as its development partner for integrated private data networks is a shot in the arm for the Westboro, Mass., computer manufacturer, which in 1987 will experience the first unprofitable year in its 19-year history [*Electronics*, Sept. 3, 1987, p. 42].



COMING FROM DG. Data General will develop hybrid exchange systems that integrate intracompany data communications.

The joint development agreement that NTT and Data General announced last week could be the first of similar affiliations between DG and U.S. and European companies in data networks. What's more, the pact is the first significant endorsement of DG's strategy to catapult into the corporate data-network business through an initiative directed by its 16-month-old Communications Systems Group.

RICH MARKET. The value of the NTT contract wasn't disclosed, but the agreement will open a new market that could be worth several hundred million dollars to the U.S. company. It calls for DG to develop integrated high-speed digital communications systems for NTT. The size and reach of NTT, which controls some 85% of Japanese communications, stamps the DG data-network organization that's evolving under senior vice president Colin Crook as a significant force.

What's more, Crook says, the agreement will help pay for DG's own development of private data-network technology. It calls for DG to deliver by spring of 1989 an integrated communications-processor system and computer system, along with hardware and software interfaces and "all the first-level communications support" required for high-speed digital communications systems, says Crook. Such systems will consist of hybrid exchange units that integrate data, voice, and computers into intelligent private networks.

A system will do more than private switching, points out Yasuharu Kosuge, senior engineer and supervisor in NTT's Integrated Communications Systems Sector. If customers select an appropriate processor model, the system will handle switching in a priority mode but will also allow them to run applications software. The computers control both circuit and packet switching over what the Japanese call a superdigital leased line, equivalent to a T1 line from AT&T Co.

Kosuge says that DG will develop interfaces to the line and to Japanese terminals, along with communications software. Kosuge hopes NTT can sell several hundred systems during the first year after development is completed. He says DG was selected for the development because "its hardware is well regarded in Japan, its maintenance and aftercare are excellent, and its communications expertise is superb."

Crook stresses that it was important for DG "to establish our bona fides [in data networks] with a company the magnitude of NTT. It's a good test of how smart we are in this business." In agreement is securities analyst John Adams, chairman of Adams, Harkness & Hill Inc. in Boston. "It's a formidable proposition to enter a relationship of this kind that includes a language barrier, and an unusual way to present your bona fides," says Adams. "But Data General needed somebody substantial to establish its credentials, and NTT is a hell of a choice."

Another analyst notes that the agreement underscores DG's technological know-how. "It bodes well for Data General that NTT passed up Japanese and other U.S. companies to go with them," says Stephen Zamierowski, who follows the communications industry for International Data Corp. of Framingham, Mass. "It shows that they passed the acid technology test, and it is a vote of confidence that they will be around for a while."

A third analyst is a little more cautious, however. Susie Peterson, who tracks the computer industry for The First Boston Corp. in New York, says the agreement is important for DG in the short term "because it will give them a lot of political good will. But a lot can happen to DG between now and the time they're supposed to deliver. If they're still a stand-alone company, this could be an important product line for them."

DG's Crook points out that NTT has about 5,000 networks installed in Japan among clients that are a veritable who's who of Japanese banks and manufacturing companies. The agreement will open an upgrade-and-replacement market to DG, which has sold minicomputers to NTT through its subsidiary, Nippon Data General, for 15 years.

GETTING TOGETHER. That relationship fostered initial meetings between Crook and other representatives of his group and NTT, during which DG learned that the Japanese giant had established a new group to concentrate on private corporate data networks, just as DG had done. "Over time," Crook relates, "NTT's senior management became impressed with our understanding of the merger of computers and communications. We knew how to position ourselves and our products, and we learned how to do business in Japan."

Crook indicates that other joint efforts will follow, though he declines to offer details. For his part, analyst Adams suggests that Northern Telecom Inc., the Nashville, Tenn., telecommunications leader, might be another logical partner. *–Lawrence Curran*

configurations, from the 18-MHz eight-user unit at about $20,000, available now, up to a $45,000 30-MHz, 50-user version, coming in early 1988.

Microproject's partnership with AT&T—which, like Mizar's, began early this year with little publicity—is an unqualified plus, says Zion Bar-el, executive vice president for sales. "Our close ties to AT&T give Unicorn B/200 customers prompt access to latest versions of Unix," among other benefits, he says.

Can such relationships turn around AT&T's 32-bit fortunes? Consultant William I. Strauss of Forward Concepts Inc., Tempe, Ariz., gives the company an outside chance. "By any standard, the 32000 is a good set that has not been marketed well. This [new strategy] shows some signs of life," he says. And AT&T has one big advantage on its side, he adds: "People are thirsty for multiuser microcomputers—and Unix is the only stuff out there." *–Larry Waller*

PRINTERS

ION-DEPOSITION PRINTER TAKES ON LASER

RANDOLPH, MASS.

Lasers most often are the technology of choice for nonimpact printing. But ion deposition is poised to make a big push into two bastions of the laser market—office automation and computer-aided design and manufacturing. That's the view of Delphax Systems of Randolph, Mass., which on Oct. 14 unveiled an ion-deposition system that for the first time combines text, graphics, a raster image processor, and printer controller all developed by Delphax—the company that holds the basic patents on ion-deposition printing.

Delphax, a seven-year-old company, had 1986 revenues of $36 million, almost doubling from 1985. It supplies printers and print engines to original-equipment manufacturers, including Datagraphix, Honeywell, Northern Telecom, Olivetti, and Xerox. Now, with shipments of its S3000G RIP-equipped printer set to start in December, those OEMs could announce 30-page-per-minute combined text-and-graphics printers by early next year. The system holds special appeal in CAD/CAM applications, because it can print arcs and vectors much faster than plotters or dot-matrix printers.

Ion printing works by projecting ions onto a dielectric drum. The images attract a toner, which is then transferred to plain paper. It has become competitive with laser technology because it withstands duty cycles that are at least as high and often higher than laser printer duty cycles, according to CAP International Inc., a Marshfield, Mass., market-research firm that tracks the printer business. For example, the 30-ppm S3000G has a specified duty cycle of 225,000 pages per month; Thomas Kinney, Delphax's vice president for marketing, says Delphax OEMs will probably price the system between $20,000 and $25,000. Comparable laser printers' duty cycles are 35,000 to 60,000 pages per month, at 20 to 40 ppm, for $15,000 to $48,000.

For CAD/CAM, the S3000G will quickly print and collate unlimited multiple copies of engineering drawings and documentation. Today, those functions often involve a separate printer for drawings and documentation, plus time to make multiple copies on a copier.

The heart of the graphics engine resides on a 14-by-16-in. board housed in a swing-out module on the back of the printer. The module also holds a 3½-in. floppy-disk drive and/or hard-disk drive.

New ion-deposition printers can do anything HP's LaserJet can do

An Intel 80286 microprocessor and 82786 graphics coprocessor make up the RIP, which provides all-points addressability plus various line-, arc-, and circle-drawing commands.

Standard electrical interfaces include Centronics and Dataproducts; Delphax will also design custom interfaces. Jeffrey Carrish, the company's director of product planning, says the floppy drive makes it easier to download new fonts or printer emulations than firmware systems.

The RIP feature is an important tool in Delphax's diversification, says Catherine Dingman, associate director for nonimpact printing at CAP International. "They started as an engine company," Dingman says, "then progressed to providing full printers, mastering the paper-path problem. Now this puts them into controllers, and while printer suppliers can get a controller company to do that job, no one knows that ion print engine better than Delphax."

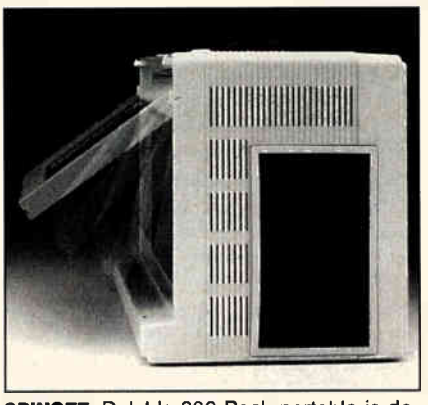
Delphax's Kinney points out that a substantial amount of printer software is being rewritten to run on networked systems—including Digital Equipment Corp. VAX systems and IBM Corp. 4341s—in market segments where nonimpact printing has yet to make significant inroads. "There are 25,000 sites where the average monthly print volume is somewhere between 100,000 to 500,000 pages," Kinney says. "Nonimpact printing has only 1% of that market, and less than 20% of the 7,500 sites where the volume is 500,000 to 2 million pages per month. Those are the markets that we're after." *–Lawrence Curran*

PORTABLE COMPUTERS

IT'S GETTING CROWDED FAST IN 80386 PORTABLES

SAN MATEO, CALIF.

The market for 80386-based portable computers is only a few weeks old, but already it's beginning to look like Times Square on New Year's Eve. Almost every week, a new player has joined the fight, resulting in a three-way battle with more on the way. Latest to join is the king of the portables, Compaq Computer Corp., which came out with its model using Intel's speedy 32-bit microprocessor at the end of September.



SPINOFF. Dolch's 386 Pack portable is derived from an instrument controller.

Starting it all off was tiny Dolch American Instrument Inc. of San Jose, Calif., which introduced a 16-MHz machine originally developed as an instrument controller. A week or so later, Toshiba America Inc. of Irvine, Calif., announced its T5100, at 15 lb the lightest of them all, so far. And the Comdex show in Las Vegas, Nov. 2-6, should add to the crowd. Grid Systems Corp. of Fremont, Calif., for example, plans to introduce a pair of 286- and 386-based laptops.

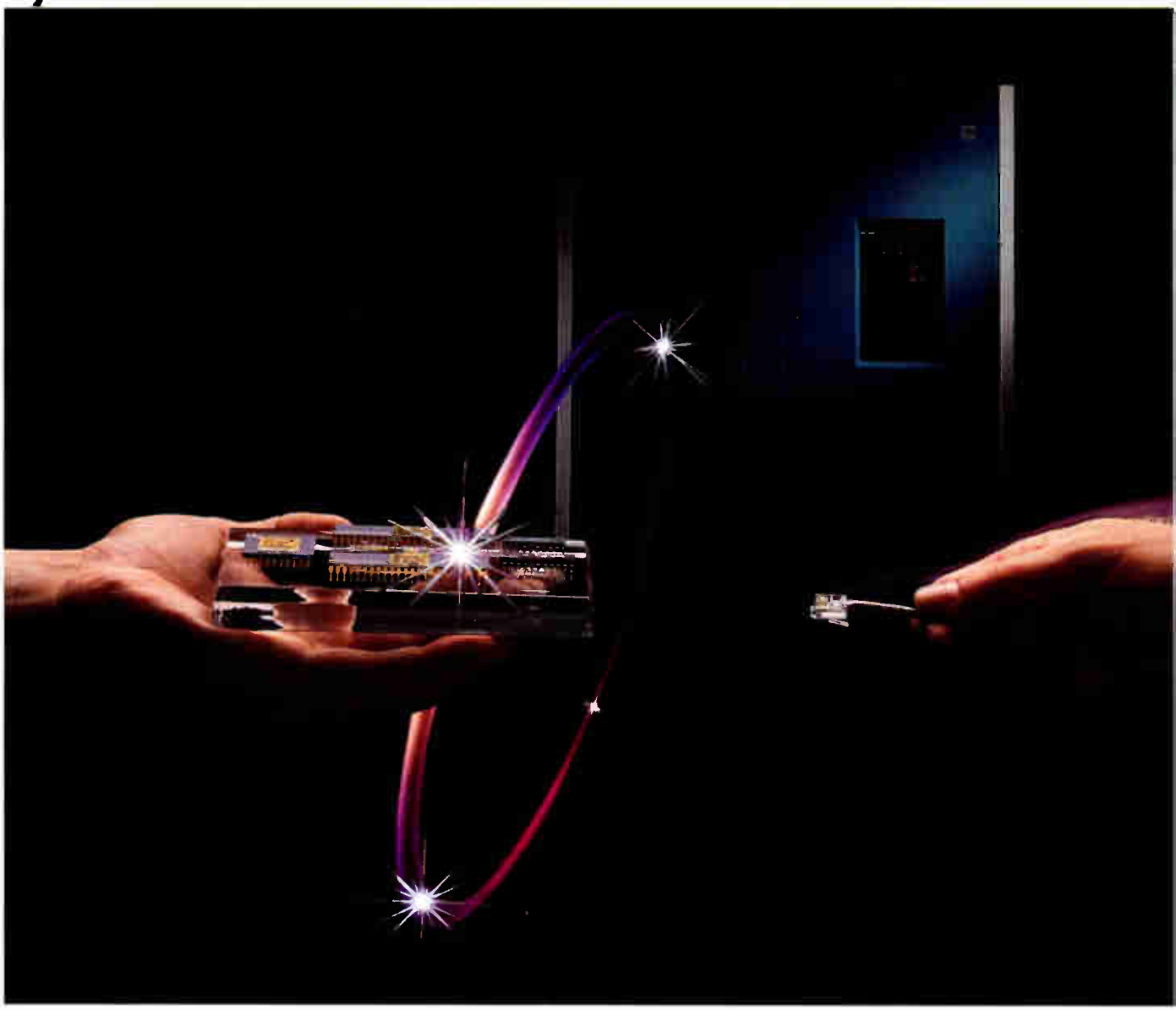
"Portable" has always been a catch-all

TEXAS INSTRUMENTS REPORTS ON NETWORKING

IN THE ERA OF MegaChip TECHNOLOGIES

Networking in the Era of MegaChip Technologies:

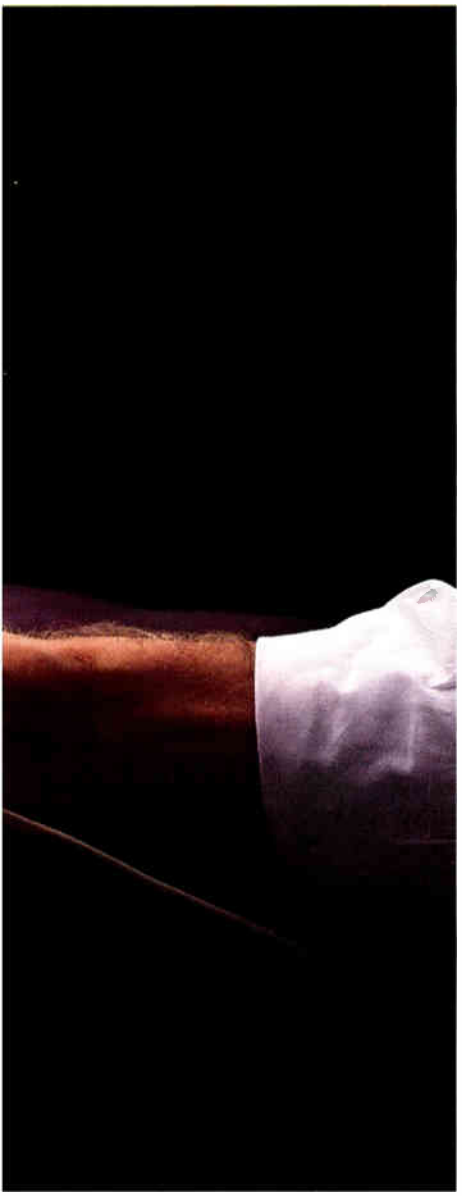
When connecting to the you need to connect with



Only the TMS380 Chip Set from Texas Instruments is tested and verified with IBM. That frees you to concentrate on the important business of making your products market winners.

Industry observers agree: The IBM® Token-Ring Network is capturing a lion's share of the LAN (local-area network) market. As stated by IBM in their October 15, 1985, product announcement, the IBM Token-Ring Network is "an 'open' network architecture for accommodation of non-IBM and IBM attaching devices . . . with semiconductor components available

IBM Token-Ring, Texas Instruments first.



from Texas Instruments." All you need to capitalize on the growing demand for products that will operate on the ring is to design with TI's TMS380 Chip Set.

"We use TI's TMS380 Chip Set and TI's implementation of IEEE 802.2 LLC protocols to ensure IBM compatibility at media-access and software levels." That is Howard S. Charney, senior vice president of 3Com Corporation, stating the chief reason for turning to TI first when designing-in token ring connectivity. You know your TMS380-based product will be 100% compatible with IBM and industry standards.

As a result, you avoid any problems of validation, verification, or long development time. You gain time to add product enhancements that can mean a competitive edge in the marketplace.

Martin Sinnott, director, Dayton Development Center of the NCR Corporation, sums up the advantage this way: "We offer the very highest level of interoperability with the IBM Token-Ring Network via TI's TMS380 Chip Set and our own software."

An integrated solution for "open" systems

TI's TMS380 Chip Set begins with a 40-million-bits-per-second DMA interface. This provides efficient connection to high-speed microprocessors such as Intel's 80X86 and Motorola's 680X0 families and open-system buses like IBM's Micro Channel™ and Apple's NuBus™.

Having built-in software jointly copyrighted by IBM and TI, the TMS380 provides all IEEE 802.5 media-access control processing, including on-board network-management services *(see box)*. In addition, the TMS380 provides capability for message-buffer expansion and higher layer protocols, such as IBM-compatible IEEE 802.2 Logical Link Control (LLC), available from TI.

The TMS380 completes your connection to the IBM Token-Ring with physical-layer interface circuits that provide clocking, data reception and transmission, and ring-insertion control.

Opening the way to internetworking the TMS380 facilitates the design of token ring bridge and gateway products.

Good news about cost

Another reason to choose the TMS380 is that the cost of connectivity is coming down. The chip set is available now at a suggested resale price under $100.00 (quantity 100).

Reliable network management

"We have designed our ProNET®-4 product using the industry-standard TI TMS380 Chip Set. In addition to normal data-communications functions, the chip set provides power-up self-test as well as network-management frames for automatic error detection, parameter services, and reconfigurations. The net effect is reliable, manageable network operation."

Howard Salwen,
Chairman and Founder, Proteon, Inc.

The TMS380 reflects the influence of TI's MegaChip™ Technologies. These are the skills and disciplines acquired through ongoing development of high-density circuits which generate advances in semiconductor design, processing, manufacturing, and service.

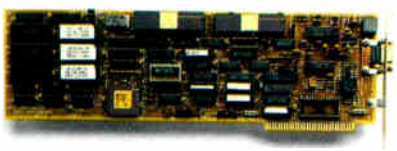
These technologies are having an effect on other LAN standards. For example, TI has developed the SN75061/62 single-channel drivers/receivers that can easily be configured for use with StarLAN IEEE 802.3 1BASE5 networks. These new devices perform data transmission/reception and minimize transmission-line noise. The SN75061 is ideally suited to 1BASE5 stations; the lower-power, lower-cost SN75062, to hubs.

For more information on the broad TMS380 support, turn the page.

Comprehensive support from TI speeds TMS380 design-in.

To help you with everything from token ring adapter-card prototyping through communications-protocol development and systems integration, TI makes available the comprehensive TMS380 Development Products Family.

Design-in Accelerator Kit includes hardware and debug software for completing a prototype token ring adapter: Three sample TMS380 chip sets, engineering debug software with User's Guide, and an interconnect schematic.



PC Adapter Card helps you develop software and analyze traffic on the IBM Token-Ring Network. It works in both the PC Family and PC AT compatibles and incorporates TI's new IEEE 802.2 LLC. The card comes with demonstration software as well as protocol-analysis software to help develop your communications protocol.

Test Wiring Concentrator (TWC) provides the mechanism for any station to be inserted on the ring and adds LEDs that indicate ring insertion.

TMS380 LLC EvaluationKit provides the hardware, software, and documentation required to evaluate the IBM-compatible IEEE 802.2 LLC software on your designs.

ASIC-LAN Tool Kit enables the fast development of highly integrated, differentiated, and compact adapters. The kit contains ASIC software macro building blocks and completed design examples. These support Adapter Memory Expansion and PC Bus Interface. The kit not only helps save board space, but also several months of system and hardware design.

TMS380 Bridge Design Kit contains one TMS38021 Bridging Protocol Handler, one set of Bridge Options Adapter Software, and a TMS38021 Bridge Application Report to help you develop bridge or gateway products.

Token Ring Seminars are conducted on request at TI Regional Technology Centers or at your site. A two-day workshop includes an introduction to the TMS380 Chip Set and hands-on experience in the lab. A one-day TMS380 Advanced Topics Workshop provides an understanding of the extended LLC interface on the TMS380 and provides insight into bridge applications.

For more information on TI's TMS380 Chip Set, call TI's hot-line number, **(713) 274-2380.** Or complete and return the coupon today to Texas Instruments Incorporated, P.O. Box 809066, Dallas, Texas 75380-9066.

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27-4512

TEXAS INSTRUMENTS

cation of these units considerably increases throughput.

One unusual feature is the multiplexed ROM, which also helps boost the throughput. To keep memory bandwidth low, the FP fetches two instructions with each memory access and processes them one after the other, while fetching the next two. This complicates pipelining somewhat but does not affect the FP's functional behavior, Winterer says.

Significantly, the controller does away with interrupts in favor of program scheduling, "because interrupt schemes considerably interfere with high-speed processing requirements and call for lots of circuitry," Winterer says. Because the FP has no interrupts, it is markedly different from most microcontrollers. Usually, any controller must respond quickly to asynchronous demands. But with common interrupt schemes, there is a need to restore the controller's internal state. With a register file, however, it either takes time to store and load all registers or it requires extra hardware to hold one or more additional file for context switching. Further, interrupting the pipeline and restoring it is a complex task, making extensive logic necessary.

So the Freiburg designers did away with interrupts, instead subdividing programs into individual tasks. While a task is running, no interrupt is allowed. When the task is completed, a hardware block, the so-called scheduler—part of the control block—decides which task must be executed next.

The scheduling scheme incorporated in the FP also supports a modular software structure, making the FP the ideal partner for fast controlling and signal-processing applications. *–John Gosch*

AVIONICS

HOW ABOUT THIS? AVIONICS WOULD GO IN PLANE'S SKIN

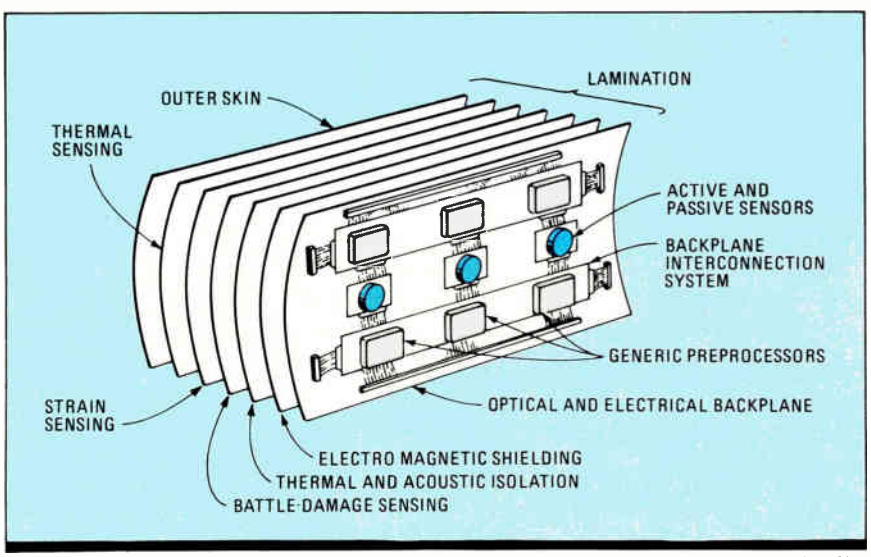
LOS ANGELES

Here's a prediction for you: the military airplane of the future will carry its sensing, communications, and processing equipment embedded in its outer skin. At least, that's the conclusion emerging from a year of study by avionics and structural engineers at GMHE/Hughes Aircraft Co. and Rockwell International Corp.

The work was done as part of the Air Force's Forecast 2 project to identify new technologies for next-century equipment. The Hughes-Rockwell concept, "smartskins," envisions flexible electronic packages holding the various avionics subsystems, which would be separated into layers and distributed over the body of the aircraft. The first usable embedded equipment could be ready in 5 to 10 years, the study says.

"This is a brand-new ballgame for avionics," says Joseph Smalanskas, laboratories engineer at Hughes, who is coordinating the two-year study. The goal is "nothing less than eliminating dedicated structures for electronics."

But first researchers have to overcome two tough technology barriers, says Smalanskas. The chief one is developing flexible optical-interconnect boards and backplane mounting to replace the rigid copper-based printed-circuit boards now in use. The boards must



NEW LOCATION. By embedding bulky computers and other avionic equipment in the skin of its airplanes, the Air Force hopes to get more efficient electronics as well as better aircraft.

← Circle 38 on reader service card

IF YOU'RE DESIGN YOU'RE WAST

Until now, if you wanted to put 50,000 gates on one chip, you usually had to put them in one at a time. You had to put in three months work. And you had to put your launch date into a holding pattern.

Not anymore.

Announcing the only compilers that take you to gate arrays and cells. Fast.

Now with VLSI's new Datapath and State Machine Compilers you can design in high level symbols instead of gates. A design that used to take months, can now be turned around in days. Even less.

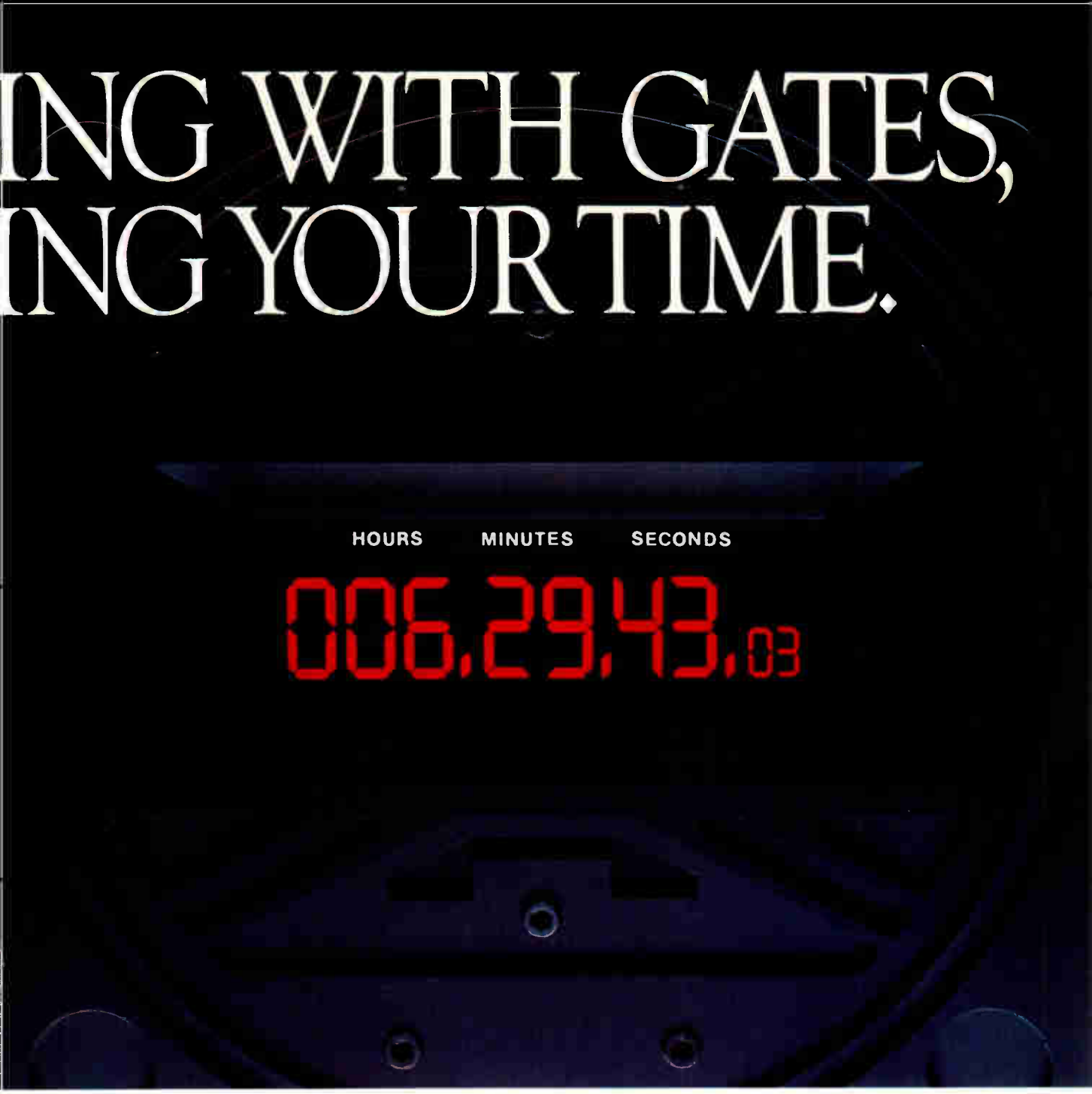
With the help of our new Datapath Compiler you can design a 64-bit RISC datapath on your lunch hour.

But can you use control logic? You bet your sweet datapath you can.

Our State Machine Compiler accepts high level expressions of logic functions and gives you tightly packed state control logic in a fraction of the time it would take to design it by hand.

We did the design entry for an asynchronous receiver in one hour. It would've taken

ING WITH GATES,
ING YOUR TIME.



seven days using traditional schematics.

And not only do we give you high integration design tools, we give you high integration devices.

Our CMOS 1.5 micron VGT100 series of gate arrays puts as many as 50,000 useable gates on a chip. And our 1.5 micron CMOS cell-based technology packs over 100,000.

If you'd like more information about our new Datapath and State Machine Compilers, and the VGT100 family of gate arrays they work with, write us at 1109 McKay Drive, San Jose, CA 95131. Or give us a call at (800) 872-6753.

We'll show you a good time.

To find out how much time you can save, call us for a free stopwatch.

VLSI TECHNOLOGY, INC.

Circle 45 on reader service card

PROBING THE NEWS

GaAs-ON-SILICON WAFERS ARE SET TO GO COMMERCIAL

WITH A DOZEN BETA SITES ALREADY, KOPIN CORP. WILL OFFER 4-in. WAFERS

by Lawrence Curran

TAUNTON, MASS.

Those chip makers eager to tap the high-performance potential of gallium arsenide should be more than a little excited about a brand new development in GaAs-on-silicon material: the commercial availability of 4-in. wafers, which are believed to be the first of their size to go on the market.

The source of these wafers, tiny Kopin Corp., was scheduled to disclose at this week's IEEE GaAs IC Symposium in Portland, Ore., that sample production had already begun on wafers measuring 2, 3, and 4 in. in diameter. Having the most potential is the 4-in. wafer, which will start shipping in December.

The marriage between GaAs and silicon [*Electronics*, Sept. 18, 1986, p. 31] is still tricky enough to prompt a wait-and-see attitude by some potential users, but the lure of joining the two materials to get the advantages of each—including the structural and thermal properties of a silicon substrate—is driving more than a dozen research efforts in the U. S. and Japan. GaAs emits light, withstands high temperatures, and survives high doses of radiation, making it attractive for optoelectronic and fast logic and memory devices, as well as for radiation-resistant integrated circuits. However, the brittleness and warping of bulk-GaAs wafers have so far limited diameters to 2 or 3 in. Also, GaAs often lacks purity when deposited on silicon.

Kopin is a three-year-old Taunton, Mass., startup that eventually will supply chip makers with production-quantity epitaxial wafers. The company has about a dozen beta-site customers for wafers, on which GaAs is grown using metallic-organic chemical-vapor deposition. John C. C. Fan, Kopin's founder, chairman, and chief executive officer, believes the commercial availability of these wafers represents "the enabling technology for future GaAs market growth."

That market has been frustrated until now, but it may indeed be stimulated by the promise of GaAs on sturdier, larger-diameter silicon-wafer substrates, promising the economies of scale associated with silicon processing. Further, the ability to selectively grow GaAs on portions of a silicon wafer holds the potential to marry CMOS FETs with GaAs optoelectronic devices, including lasers. Texas Instruments Inc. is working on this kind of patterned deposition in its Central Research Laboratories in Dallas. So is GTE Laboratories Inc. in Waltham, Mass.

Wafer- or device-level programs are perking along with more than a dozen other entries in the GaAs-on-silicon sweepstakes in the U. S. and Japan. They include Fujitsu, Hitachi, Mitsubishi, NEC, NTT, Oki Electric, and Sharp in Japan, plus AT&T Bell Laboratories, Ford Microelectronics, Hewlett-Packard, and Spire in the U. S.

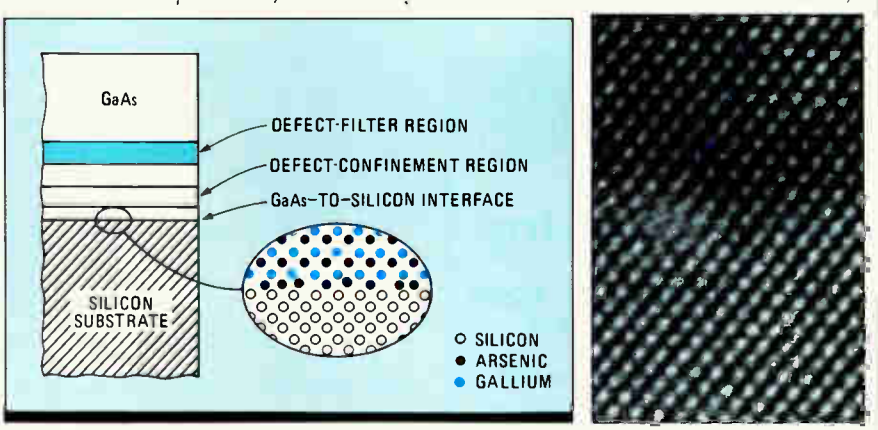
SPECIAL SILICON. There's not much that Fan wants to divulge about the way Kopin makes its wafers, but he does say that the company buys specially cut silicon wafers. "It is still 1-0-0 material, but it has a slightly different orientation," Fan says. That orientation, plus several processing steps, are intended to minimize defects and warping.

Kopin uses a proprietary cleaning process before putting the wafers into a modified chemical-vapor-deposition reactor. Two steps deposit a very thin "defect-confinement" layer before the GaAs is put down. The entire epilayer is a maximum of 8 μm thick, and usually more like 5, Fan says. Thermal cycling follows to help take care of stress and lattice mismatches, says Fan.

One of the biggest U. S. development efforts is at Texas Instruments Inc., where blanket deposition of GaAs across an entire wafer last year proved the quality of epitaxially grown GaAs on a passive silicon substrate. That work resulted in the most complex GaAs-on-silicon devices reported to date in the U. S.—fully functional 1-Kbit static random-access memories with address-access times as short as 6 ns [*Electronics*, Sept. 18, 1986, p. 31].

The thrust of TI's current effort is directed at patterned deposition, so that some circuit functions are done in GaAs and others in silicon. Its method is to grow GaAs through silicon-dioxide or silicon-nitride masks, a technique that "allows us to place single GaAs pads wherever we want on a silicon wafer," says Richard Matyi, a member of the technical staff in TI's Materials Science Laboratory. Hisashi Shichijo, senior member of the technical staff in the GaAs Logic and Memory Branch of TI's Central Research Laboratories, adds that the lab initially will use patterned deposition to combine silicon CMOS circuitry with GaAs MES FET circuits.

"Once you develop the technology to combine these two kinds of devices, you aren't limited to MES FETs or CMOS,"



LATTICE MISMATCH. Different lattice dimensions in silicon and GaAs result in interface dislocations (seen as a fuzzy spot in TI photo). Defects can propagate from them into the GaAs.

We're growing with speed and resolution.

Introducing the best spectral performance available in 14 and 16-bit sampling ADC's.

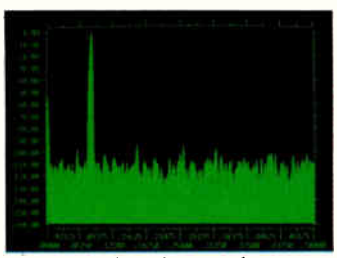
Step-by-step, Analog Solutions is covering all key points on the speed/resolution scale.

We already have the largest line of high performance 16-bit ADC's. Now, in response to customer needs, Analog Solutions is introducing significant new products in a growing family of sampling A/D converters.

Leading off is the ZAD2764. This 14-bit sampling ADC offers a better combination of speed and resolution than anything you've seen before. The ZAD2764 features a 500 kHz sampling rate and a built-in ultra-linear sample and hold. Spectral performance is fully specified and guaranteed. Harmonic distortion, intermodulation distortion, S/N ratio and frequency response are specified under worst-case conditions. When you design the ZAD2764 into your telecommunications, medical imaging or ATE system, performance will not be compromised.

Equally impressive is the ZAD2846, a 300 kHz sampling 16-bit ADC with the best linearity and lowest noise and harmonic distortion available. With its low drift and guaranteed specs, the ZAD2846 satisfies the most demanding applications. The FFT diagram shows the actual performance.

Both new products use the latest technology and Analog Solutions' proprietary digital correction subranging architecture.



Actual spectral performance of ZAD2846

Both are packaged in Analog Solutions' rugged, shielded metal case with low insertion force sockets and are pin-to-pin compatible with each other. So you can change system performance by simply swapping modules.

And both are 100% tested and documented to guarantee that published specifications are met.

If you need the performance that exceeds monolithics, hybrids, or your own ADC/sample and hold design, give us a call.

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ANALOG SOLUTIONS

A subsidiary of Silicon General.

Circle 49 on reader service card

YOU'RE ON AS YOUR

When you're trying to build the hottest new products you can think of, you need the latest, most sophisticated ASICs available. And the greatest number of ways to use them.

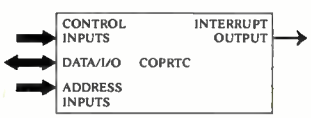
And that's the whole idea behind our Triple Technology.™ Which gives you the ability to combine analog, digital, and E^2 cells all on the same chip. And the confidence that they all fit

SEPTEMBER

Real-time Clock for COP™ 800 Microcontroller Core

Key Features:

- Parallel interface to Sierra core cell
- Low power/independent operation
- Programmable interrupt system
- In-cell 32 KHz micropower crystal oscillator
- Timekeeping from 1/10 sec. to years
- Available in Sierra's 2-micron CMOS standard cell library.



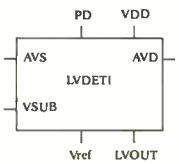
The COPRTC Real-time Clock peripheral has a direct interface to the COP800. It's 32 KHz crystal oscillator allows independent operation while the controller core cell is in a low-power halt state. The interrupt timer can "wake up" the controller at user-programmable intervals. This peripheral keeps time with tenth-second resolution and includes an automatic leap year calculation. Of course, it is also fully compatible with all the digital and analog cells in our Triple Technology™ 2 micron CMOS cell library.

OCTOBER

LVDET1 Low Voltage Detector

Key Features:

PARAMETER	Min	Typical	Max	Units
Supply Range	2.5	5.0	5.5	Volts
Negative going trip point, Vtr−	3.7			Volts
Positive going trip point, Vtr+			4.5	Volts
Hysteresis (Vtr+)−(Vtr−)	200			mV



This cell can be used to detect low battery voltage. Or to power down an electronic system safely in case of power interruptions, then reset it when power is restored. In either case, when power supply voltage drops below a specified value, this precision circuit provides a logic output. With built-in hysteresis and inherent low-pass filtering, it is immune to errors caused by small supply variations and spikes. It is also a perfect example of our commitment to introduce a new high-performance cell every month throughout 1987. Watch this space for November's cell.

LY AS GOOD LAST IDEA.

ɔgether, since they've all come from the same ɔurce. Of course, we already give you the ichest cell library in the industry. But every ıonth this year, we'll use this space to introduce our latest ideas. To give you more possibilities than ever. If you'd like to see our complete library card, just write or call. In the meantime, just look what we've done for you lately.

NOVEMBER	DECEMBER

Sierra Semiconductor
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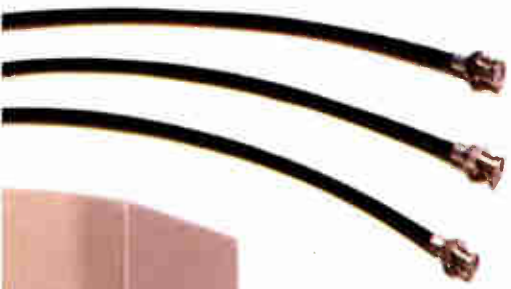
2075 North Capitol Avenue, San Jose, California 95132. Telephone (408) 263-9300

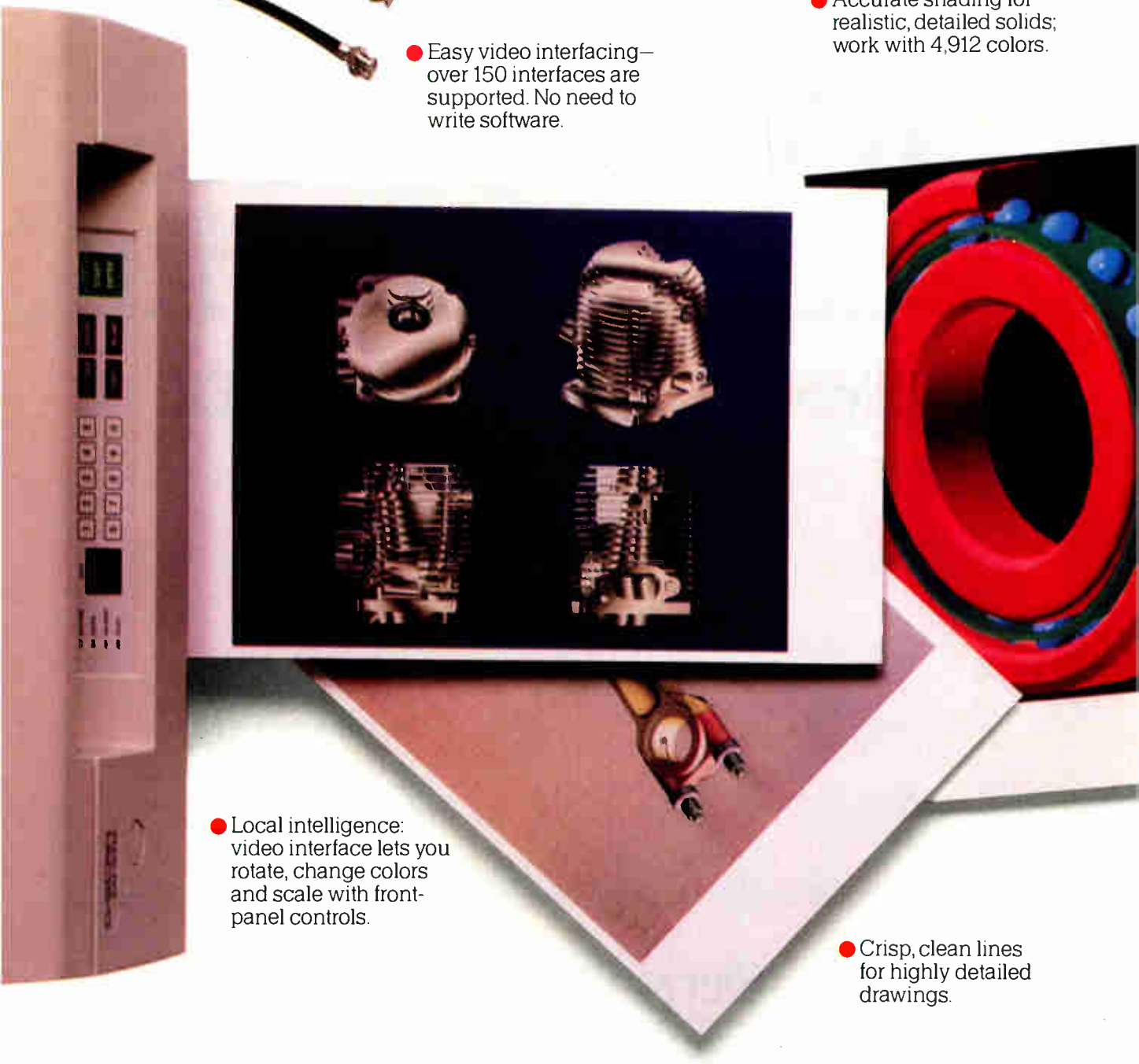
Circle 51 on reader service card

● Both parallel and RS-232 interfaces are supported by a wide selection of software.



● Easy video interfacing—over 150 interfaces are supported. No need to write software.

● Accurate shading for realistic, detailed solids; work with 4,912 colors.



● Local intelligence: video interface lets you rotate, change colors and scale with front-panel controls.

● Crisp, clean lines for highly detailed drawings.

NO OTHER COLOR HARDCOPIER CAN MAKE THESE POINTS.

The CH-5300 gives you fast copies. Sharp lines. Realistic gradation and shading. Bright, rich solids. Consistent backgrounds. Built-in intelligence. Easy interfacing to the broadest range of video or parallel sources. And proven reliability.

Plus, with our new multiplexor you can turn your color hardcopier into a shared resource; connecting up to four different input sources at once.

So look into the Seiko CH-5300. You'll see that no other color hardcopier can make these points.

Call Martin Nelson at (408) 943-9100 today.

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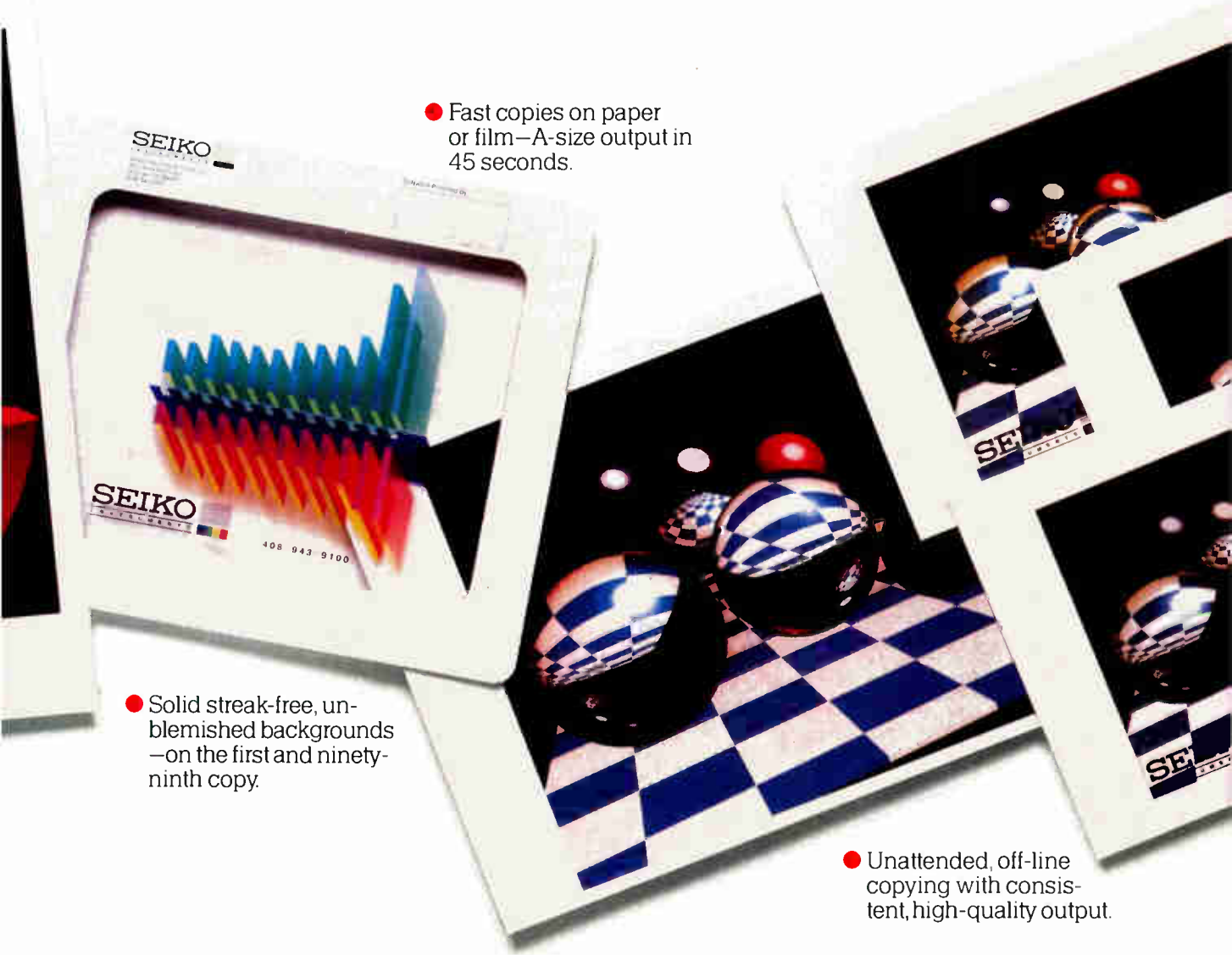
Seiko Instruments USA



- Fast copies on paper or film—A-size output in 45 seconds.
- Solid streak-free, unblemished backgrounds—on the first and ninety-ninth copy.
- Unattended, off-line copying with consistent, high-quality output.

Circle 53 on reader service card

INTERNATIONAL WEEK

CASIO ENTERS DAT AND VCR MARKETS

Casio Computer Co., Tokyo, a leading manufacturer of calculators, watches, and liquid-crystal-display color TVs, is diversifying into the digital-audio-tape recorder and portable video-cassette recorder markets. It will start selling its 148,000-yen portable DAT, DGZY1, in December, about the same time as Matsushita and Sony go to market with theirs. The initial production rate will be 1,000 units a month. The portable VCR, VF-3000, has a built-in 3.3-in. liquid-crystal TV that can reproduce color images on its 118,580-dot display and receive off-the-air TV programs. Casio will start marketing the VF-3000 in mid-December at 125,000 yen with another 27,000 yen for accessories, initially producing 3,000 units a month.

TOSHIBA TO SELL 3-D CAMCORDER

Toshiba Corp., Tokyo, has developed 3D-CAM, the world's first camcorder capable of recording three-dimensional color pictures that can be played back on conventional VHS-format VCRs and a monitor with double scanning speed. Liquid-crystal-shutter glasses are required to view the 3-d images and a special adapter unit is needed for playback on standard VCRs. Toshiba will sell the camcorder for industrial as well as home use. It has not yet decided when to begin marketing the 3D-CAM, but it expects to price it at around 300,000 yen, 50% higher than the price of standard camcorders.

GERMANS GET FAST FIBER-OPTICS LINK

West Germany's Siemens AG has turned over to the Bundespost, the communications authority, the country's first fiber-optic line operating at a 565-Mbit/s data rate. With 32 glass fibers in a cable spanning the 100 miles from Munich to Nuremberg, the link will have a capacity for 120,000 telephone channels or 64 TV channels, each with a 140-Mbit/s rate. The use of monomode fibers allows a repeater spacing as wide as 35 km.

FINNS, SWEDES GET VIDEOPHONE LINK

Finns and Swedes can now make videophone calls as easily as ordinary telephone calls. The first international videophone call was made from Helsinki to Stockholm on Sept. 24, using a digital link between the two national switched 64-Kbit/s networks. The videophones were made by Vistacom Industries Inc., a new Finnish company that makes color video codecs and terminals for 64-Kbit/s networks. Called Diginet, the switched 64-Kbit/s service is compatible with the Integrated Services Digital Network, with which it competes, and is supported by Nokia, Ericsson, and Siemens.

TURKS BUY SIEMENS DIGITAL SWITCHES

Turkey has become the 30th country to order an EWSD digital switch from Siemens AG, Munich. The order initially is for nine systems, capable of handling a total of 100,000 subscriber lines, to be used in eight cities throughout the country. Starting in 1988, the Turks will build EWSD systems on their own in a factory for which about $23 million has been earmarked by the Ankara government.

PLESSEY, TELENET IN DATACOM VENTURE

The Plessey Co. plc and Telenet Communications Corp., a US Sprint company in Reston, Va., have formed a joint venture company, Plessey-Telenet Ltd., to market data-communications and packet-switched networks and systems, initially in the UK and Holland. Ownership of Plessey-Telenet, which will be based at Basingstoke, England, is 51% Plessey, 49% Telenet. Plessey-Telenet already has orders valued at £30 million with ongoing contracts for private packet-switched networks.

VENEZUELA TO BUY ERICSSON SYSTEM

Ericsson Radio Systems of Stockholm, Sweden, has received a letter of intent from the Venezuelan Telephone Administration for a cellular mobile telephone system initially valued at $12 million. The system will consist of one AXE mobile telephone switch and 10 radio base stations. Venezuela will be the first Latin American country to operate a fully automatic cellular service, the first phase of which will be installed in the Caracas area.

ARIANESPACE HAS EDGE OVER NASA

Now that its Ariane V19 booster has placed a dual payload into transfer orbits, Arianespace says it has received 44 contracts running into 1991 for launching satellites. The orders, worth $2.38 billion, include nine U.S. private satellites. The consortium has offered to launch Indonesia's Palapa B-2R telecommunications satellite earlier and at a price 10% less than that of a U.S. Delta rocket launching, but a contract has not yet been signed.

PHILIPS, FLUKE PACT IS SET

Philips Test & Measurement of Eindhoven, the Netherlands, and John Fluke Manufacturing Co. of Everett, Wash., have set the terms of their March agreement [*Electronics*, April 2, 1987, p. 55]. Fluke will sell, service, and support Philips's products in North America, China, Hong Kong, and Japan, while Philips will reciprocate for Fluke's products in the rest of the world. The accord also provides for technology transfer and joint product development.

ALCATEL LANDS TWO VIDEOTEXT ORDERS

Alcatel NV received two large orders in September to make videotext systems similar to the French Minitel for the Centre d'Excéllence en Télécommunications Intégrées in Montreal and for Encode International in Houston. The Canadian contract calls for 100,000 terminals during the next 14 months and another 100,000 per year for the next five years. The contract with Encode calls for an initial 12,000 videotext terminals, with orders for 5,000 to 10,000 per month to follow.

UNIX-BASED MICROS COMING FROM BULL

France's Groupe Bull is making a play for the small-to-medium-size business-computer market in most of Western Europe, which it expects to reach 12.5 billion francs soon, with Unix-based super microcomputers in the Questar 700 family. The Bull Questar 700/15, 700/20, and 700/30 are being offered in compact frames for unit prices ranging from 140,000 to 210,000 French francs.

UK BOOK-TO-BILL SLIPS BELOW ONE

The UK book-to-bill ratio for electronic components in August fell below parity at 0.94 for the first time since November 1986, says the Electronic Components Industry Federation. Despite the low figure, which is typical of ratios in the second half of the year, sales continue to show slow, steady growth. Demand in consumer electronics was strong, the ECIF says, but defense was sluggish.

pendence on component tolerances.

Data exchange between the 7310 and 7320 is over the Philips I²S (for inter-IC signal) bus. This three-line bus dedicates one line each for the clock, serial data, and control data. Since I²S was also used in the Philips second-generation set, a combination of second- and third-generation devices can be used in the same system.

The 7310 and 7320 are both available in a 44-pin quad flatpack. The 7310 can also be had in a 40-pin dual in-line package which can be used as a replacement for the 7210 of the second-generation set. Samples of the two devices will be available in the fourth quarter.

Prices for the two circuits depend on importing country and local market demand. However, as an indication of approximate prices, the SAA7310 costs around 36 Dutch guilders apiece in 1,000-lot quantities and the SAA7320 about 40 Dutch guilders apiece, also in 1,000-lot quantities.

– John Gosch

Philips Elcoma, P. O. Box 523, 5600 AM Eindhoven, The Netherlands.
Phone 31-40-722091 [Circle 500]

SPECTRUM ANALYZER STORES 128 KBYTES

The MS2601A spectrum analyzer handles signals ranging from 10 KHz to 2.2 GHz and is the first in Anritsu Corp.'s product line to offer plug-in memory cards that provide up to 128 Kbytes memory for storing measurement parameters and traced data.

Microprocessor control ensures measuring accuracy to 1 dB in a dynamic range of 75 dB. The MS2601A also offers ease-of-use features such as zone markers—to locate signal peaks—screen scroll, and a frequency counter.

Applications include frequency and impedance measurements, electromagnetic interference analysis, and network analysis. The MS2601A is available now. Price depends on importing country.

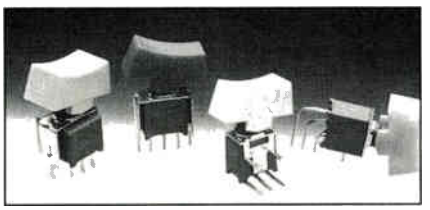
Anritsu Corp., 5-10-27, Minami Azabu, Minato-ku, Tokyo , Japan 102, Japan.
Phone 81-3-446-1111 [Circle 701]

SWITCHES SHRUG OFF SOLDER CLEANING

The TR series of sealed subminiature switches from MORS Composants can be soldered and cleaned on printed-circuit boards without danger of malfunction due to contamination.

Their small size—9.1-by-8.1-by-7.1 mm—means they take up minimal space on a pc board. They feature a rocker actuator and come with gold- or silver-plated contacts.

The two-position versions have a projected operating life of 60,000 operations



and the three-position versions have a projected life of 30,000 operations.

Available now in a variety of colors, export pricing for the TR series of miniswitches range from $1.25 to $2.50 each in volume purchases.

MORS Composants, BP No. 1, 82300 Caussade, France.
Phone 33-63-93-14-98 [Circle 702]

BACKPLANES INCLUDE TERMINATION CIRCUITS

British Telecom's 4610 series of backplanes for the emerging STEbus industrial standard saves users £30 usually spent on separate termination modules by integrating all bus-termination circuitry into the board.

On-board termination circuitry is located between the connectors to minimize system size. The board's multilayer construction implements separate 5-V supply and ground planes, giving the boards high immunity to noise and crosstalk.

The backplanes are supplied populated with female DIN41612 connectors on a standard 0.8-in. pitch and cost £65 and £105 respectively for 5- and 10-slot versions. They are available now.

British Telecom, Microprocessors Systems Group, Martlesham Heath, Ipswich IP5 7RE, UK.
Phone 44-473-643-101 [Circle 703]

DAC BOASTS FAST SETTLING TIME

Ferranti Electronics Ltd.'s ZN599 8-bit digital-to-analog converter has a typical output voltage settling time of 1.25 μs and a gain temperature coefficient of 2 parts per million per centigrade degree.

Designed to provide complementary conversion functionality for the company's ZN449 analog-to-digital converter in microprocessor-based systems, its maximum linearity error is plus or minus the least significant bit and monotonicity is guaranteed over the commercial operating temperature range.

Available now, the DAC comes in 16-pin plastic or ceramic dual in-line packages and in the SO-16 package for surface mounting. The device costs £1.81 each in 100-unit quantities. Export price is $2.98 U. S.

Ferranti Electronics Ltd., Fields New Road, Chadderton, Oldham, Lancashire OL9 8NP, UK.
Phone 44-61-624-0515 [Circle 706]

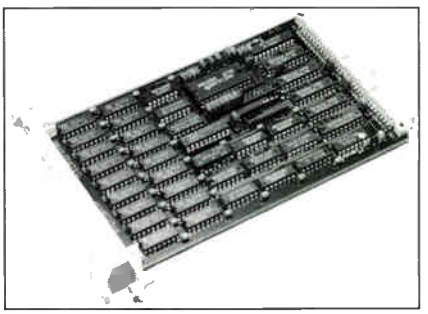
RAM CARD ALLOWS MEMORY-MAPPED I/O

The 512K8 dynamic random-access memory module from PEP Modular Computers GmbH implements memory-mapped input/output and has hidden refresh for the intelligent I/O channel. Its capacity extends from 64 Kbytes up to 512 Kbytes, with one-bit parity generation and check.

The module has 20 address lines for operation in the extended 1-Mbyte address range but may also be used in the basic 64-Kbyte address range. Within the address range, up to 16 blocks can be selected, allowing memory mapped I/O in the module's range.

The 512K8 may be used in synchronous or asynchronous bus systems. The asynchronous access improves data throughput and optimizes system speed. For synchronous operation, a bus frequency up to 2 MHz is available. The module has an access time of 250 ns.

For every written byte, one parity bit is generated and stored. This parity is com-



pared with the parity of the data byte during the read operation. A bus error signal is generated if the parity does not match. This allows detection of one-bit errors. The 512K8 module is available from stock for a price of 950 DM.

PEP Modular Computers GmbH, AM Klosterwald 4, D-8950 Kaufbeuren, West Germany.
Phone 49-8341-81001 [Circle 704]

PHILIPS HYBRIDS CUT NOISE 25%

The OM2000 wideband hybrid integrated circuit amplifiers from Philips offer noise figures about 25% less than existing equivalents in the Philips product line. The 12-V hybrid amplifiers, for room antenna, mast antenna, and community antenna TV systems, are aimed at wideband amplification in the range from 40 to 860 MHz.

Type numbers in the range are the OM2045, OM2050, OM2060, OM2061, and OM2070. The OM2045 has a gain of 12 dB with a noise figure of just 3.6 dB. The OM 2070 occupies the other end of the range and offers a 28 dB gain and a noise figure of 4.8 dB. Compact in design, the devices measure from 14-by-8

mm for the OM2045 to 27-by-22 mm for the OM2070.

The hybrid amplifiers are implemented in thin-film technology. They have a source and load impedance of 75 Ω and an operating ambient temperature range from −20°C to +70°C.

Small quantities are available from stock. In 100-piece lots, the devices cost from 7 to 10 Dutch guilders apiece, although actual prices depend on type, order quantity, and importing country.

Philips Elcoma Div., P.O. Box 523, 5600 AM Eindhoven, The Netherlands.
Phone 31-40-757005 [Circle 707]

CAD DRAWINGS CAN BE SHOWN ON BIG SCREENS

Electrohome Ltd.'s ECP 3000 video projection system uses three-lens technology to deliver resolutions suitable for projecting computer-aided design drawings on 5-ft. to 25-ft diagonal screens.

The unit accepts inputs directly from video and high-resolution graphics terminals and has a memory capacity sufficient to store setups for 28 input parameters such as brightness, contrast, and convergence.

It automatically locks into horizontal scan rates of 15 to 50 KHz and offers 650 lumens peak light output. Horizontal retrace time is less than 4μs and vertical retrace is less than 300 μs.

Available now, the ECP 3000 costs $14,995 U.S.

Electrohome Ltd., 809 Wellington St. N., Kitchener, Ontario, Canada N2G 4J6.
Phone (519) 744-7111 [Circle 705]

POWER UNIT OFFERS SIX VOLTAGE OUTPUTS

The LNG series power supplies from Heinzinger GmbH feature reasonable price and six voltage outputs. The LNG 100-1, for example, costs less than 850 DM and provides 16-, 32-, 50-, 100-, 175-, and 350-V outputs. The power ranges are 100, 200, and 500 W.

Intended for laboratory use, the supplies have a three-digit voltage and current display, a 10-gang potentiometer for voltage and current, and analog programming inputs and monitor outputs. They are designed for continuous operation and are short-circuit-proof.

The LNG 100-1 can be delivered in 14 to 16 weeks. It sells for 832 DM.

Heinzinger GmbH, P.O. Box 1076, D-8200 Rosenheim, West Germany.
Phone 49-8031-44040 [Circle 709]

COMPUTER REPLACES FOUR VMEBUS BOARDS

The CC-97 single-board computer from Compcontrol BV integrates the functionality of four separate boards in 16-bit VMEbus systems. It includes the processor; a Small Computer Systems Interface; 2 Mbytes dual-ported dynamic random-access memory; and 384 Kbytes of static RAM and erasable programmable read-only memory.

It can be used as a serial communication controller in SCSI applications or as a central-processing-unit board in multiprocessor systems. It is particularly well suited for multiprocessing because it generates and accepts seven layers of interrupt, can issue requests over the bus using any of four priority levels, and implements a mail-box function for message passing.

Key chips on the board include a 16-MHz Motorola Corp. 68000 microprocessor and a Western Digital Corp. WD33C93 SCSI controller.

The board is available now. Export price is $3,685 U.S. Price in the Netherlands is 7,250 Dutch guilders.

Compcontrol BV, Stratumsedijk 31, P.O. Box 193, 5600 AD, Eindhoven, The Netherlands.
Phone 31-40-1249-55 [Circle 708]

MINI TRANSFORMERS RANGE FROM 0.8–30 VA

Miniature transformers in the OB (for on-board) series from Avel-Lindberg Ltd. offer a load-specification range of 0.8 to 30 VA and conform to eight international standards. The 0.8 VA version stands only 10.5 mm high.

Low profiles allow the 0.8-VA transformers to be mounted where there is just 0.5-in. board spacing. The 2-VA version accommodates board spacings as little as 0.75-in. spacing, and the 4-, 6-,10- and 14-VA versions accommodate 1-in. spacing.

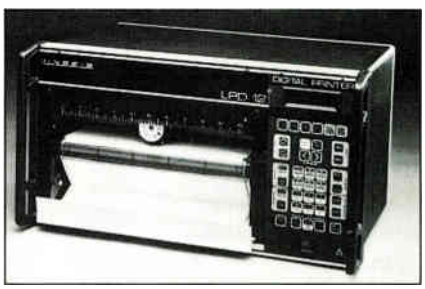
The 18-, 24-, and 30 VA versions can be mounted on boards with 1.5-in. spacing. Dual primary windings can be connected in parallel with 120-V ac and in series with 240-V ac power supplies. Nominal operating frequencies are 50 or 60 Hz.

Available now, pricing on the OB series depends on importing country.

Avel-Lindberg Ltd., South Ockendon, Essex RM15 5TD, UK
Phone 44-708-853-444 [Circle 710]

DIGITAL SERVO SPEEDS PRINTER

The dot-matrix printer LPD12 from Linseis GmbH uses a digital servo system instead of the print-head servomotor and potentiometer of conventional printers to achieve a response of 0.25 s for 250 mm—twice as fast as units with print-head servomotors and quieter in operation, too. Wear on the servo system is reduced by the use of an optical encoder.



Each of the 24 or 36 channels is programmed by a menu-driven liquid crystal display of two lines—with sixteen digits/line—and a keyboard with 33 pushbuttons. Commonly used functions can be selected by push button.

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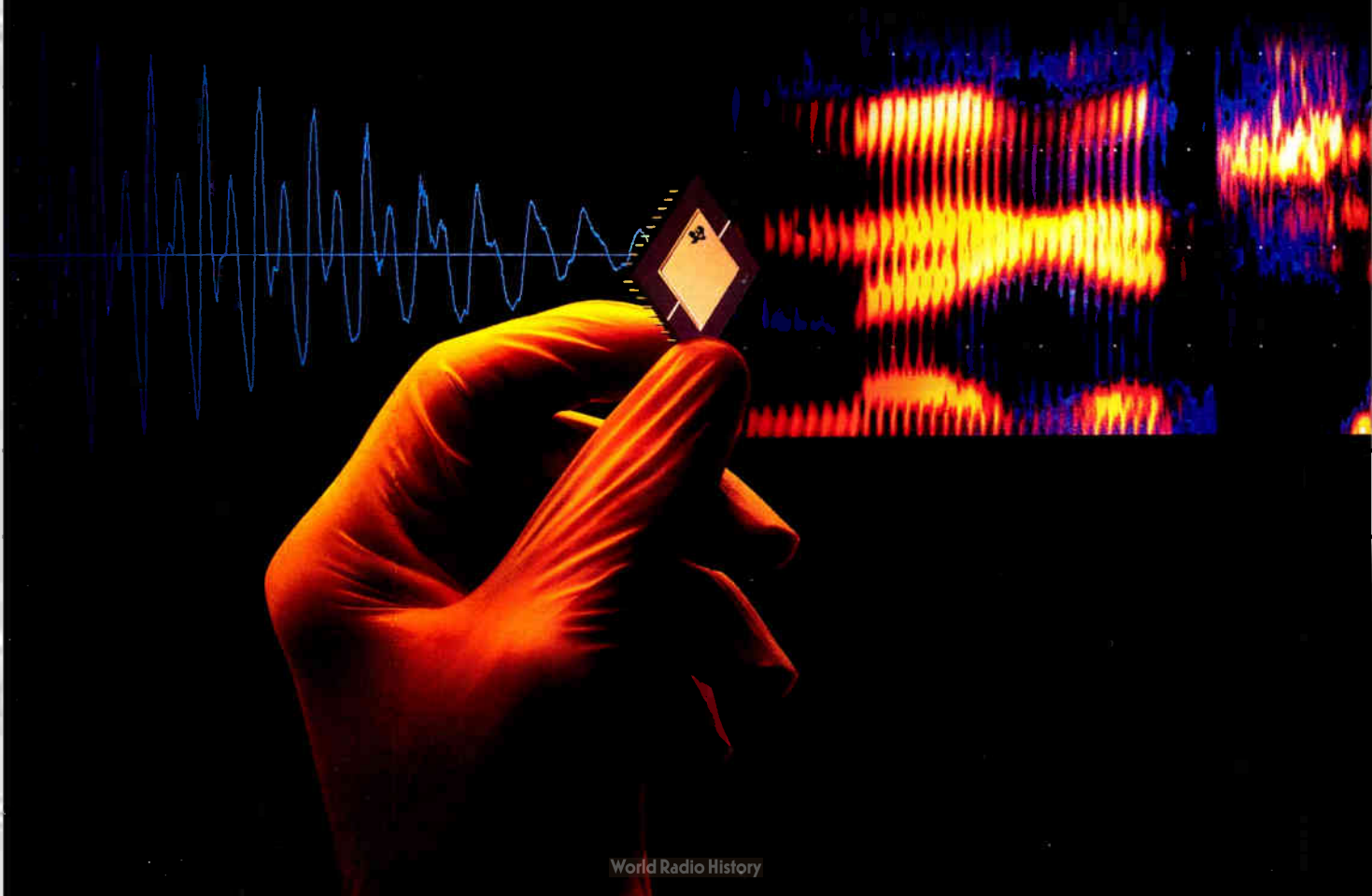
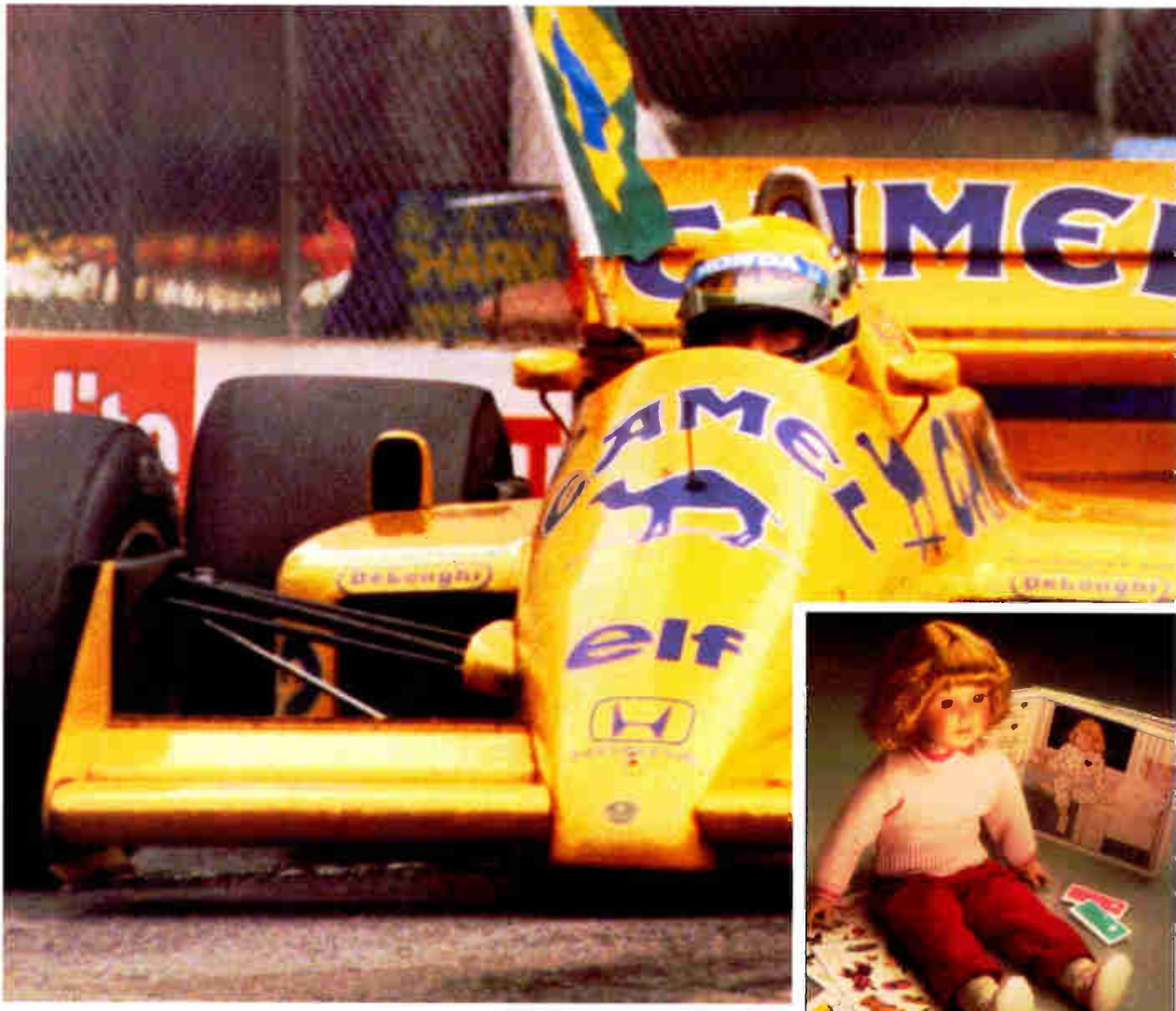
TEXAS INSTRUMENTS REPORTS ON DSP

IN THE ERA OF MegaChip TECHNOLOGIES



DSP in the Era of MegaChip Technologies:

Digital signal processors are turning up winners



TI's TMS320 DSPs add high performance at costs low enough to open new worlds of applications — from a high-performance Formula 1 car suspension to an intelligent doll and everything in between.

The results are in. You can add more performance at lower cost designing with the standard in digital signal processors (DSPs), TI's TMS320 family. There are now even more reasons than ever to get the advantages of TI DSP performance in applications wherever realtime number crunching is essential.

from Texas Instruments in all sorts of places.

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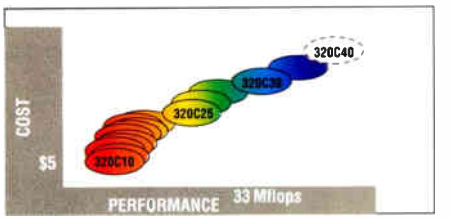

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For more information on support for the TMS320 family, please turn the page.

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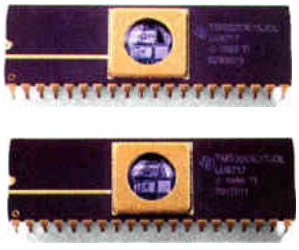

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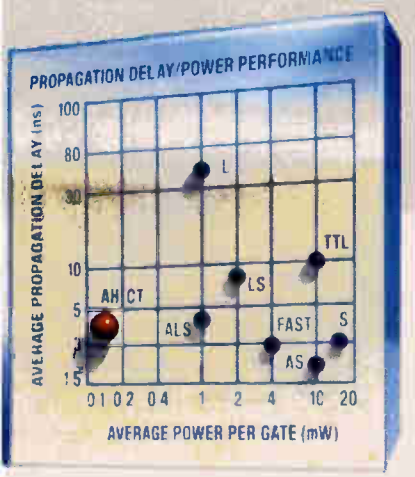

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Gates and Inverters

00	20
01	21
02	22
03	27
04	30
05	32
08	51*
09	58*
10	86
11	132*
12	133*
14*	266

Buffers & Line Drivers

125*	367
126*	368
210	465*
240	466*
241	467*
244	468*
365	540
366	541

Flip-Flops

73	399*
74	534
76	564
78	574
107	670*
109	794*
112	821*
173*	822*
174	823*
175	824*
273	825*
374	826*
377*	

Latches

75*	793*
77*	841*
259	842*
373	843*
533	844*
563	845*
573	846*

Transceivers/Registered Transceivers

242*	643	652*
243*	645	658*
245	646	659*
640	648	664*
	651*	665*

Counters

160	190	590*
161	191	591*
162	192	592*
163	193	593*
168	390*	
169	393	

Decoders/Encoders

42*	148*	238
138	154*	239
139	155*	

Multivibrators

121*	123*	423*

Multiplexers

151	253*
153	257
157	258
158	352*
251	353

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164	299*
165	595*
166	596*
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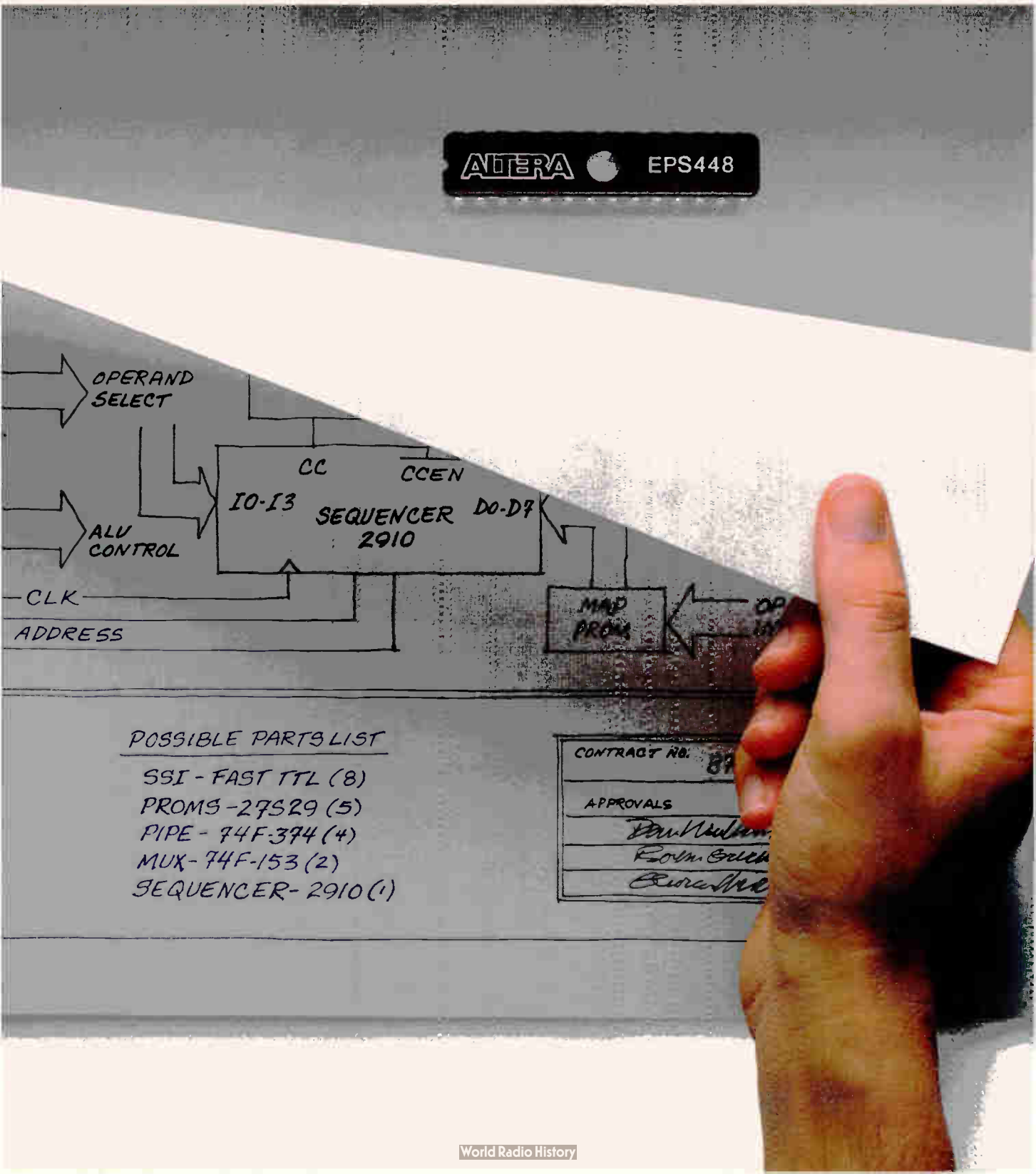

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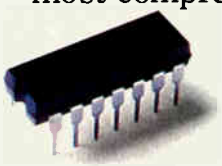

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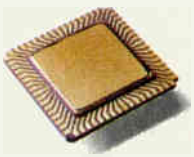

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INSIDE TECHNOLOGY

UNIX: LOOKING BETTER

A big European push and agreement on interfaces move it closer to a worldwide standard; work stations have fallen in line and high-performance PCs are next

by Jeremy Young and Tom Manuel

The position of Unix as a world standard appears all but assured now. It has won the engineering and technical work-station market and looks like a strong candidate to capture a significant portion of high-performance personal computing. The promise of standards is the user's independence from a specific vendor's products—the customer's ability to pick and choose from a variety of applications software and hardware type, size, and cost.

A flurry of standards activities, some of it outside the realm of operating systems, is contributing to the health of Unix. The strongest sphere of support is from the major Western European computer makers (see p. 70), who have embraced it for all but their biggest mainframe systems. The only laggard is Japan, but Unix is making progress there, too (see p. 72).

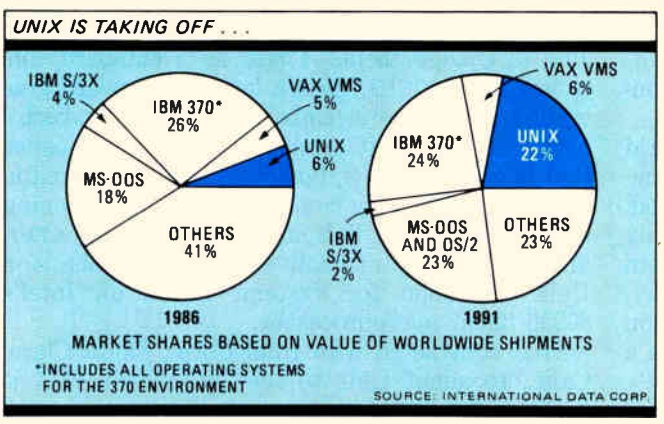
Unix has clinched the technical work-station market with a whopping 83% share (see table, p. 68), and now it's spreading elsewhere. Growth in the Unix-system markets is expected to outstrip that of other computer environments during the next few years (see chart, below).

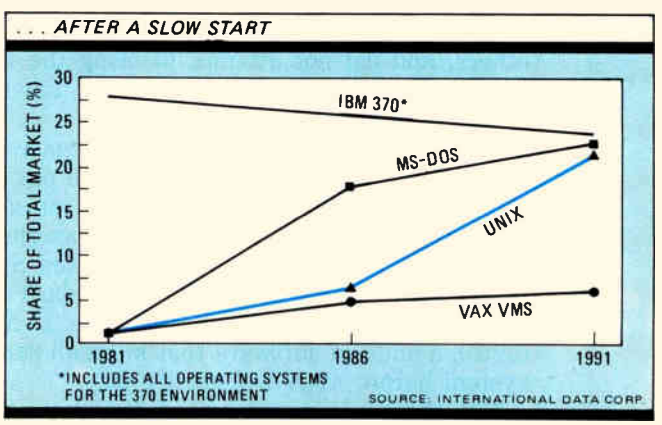
But this kind of growth will not occur without more help from the standards bodies. AT&T Co. has a certification process for compliance to its System V standard, but the industry wants control of the standard to rest outside any single company. Now the IEEE has come up with a fledgling draft standard for a programming interface, called Posix.

One of the most exciting developments is the likely emergence of a single Unix version for the Intel 80386 processor. This Unix is expected to give the OS/2 operating system being developed by IBM Corp. and Microsoft Corp. for IBM's PS/2 personal computers a run for its market.

Unix is having a twofold impact on the computer industry: it plays a leading role as a standard operating system for software portability and it acts as a catalyst for the push for open-systems standards worldwide. Unix is a rallying point around which other standards, such as network file systems, windowing user interfaces, and networking computing are being created.

Emerging standards such as the X Windows networked windowing system, Sun's Network File System, AT&T's remote file system, the X/Open standards, and the IEEE's 1003.1 Posix standard, and many of the Open Systems Interconnection communications standards as well, are outgrowths of the striving for open systems that began with Unix. These standards at least





to Interactive Systems Corp. of Santa Monica, Calif., which produced a Unix port called 386/IX. It is System-V.3-compatible, and can run MS-DOS applications.

Now Interactive Systems has a signed contract with Microsoft Corp., Redmond, Wash., to produce what it calls a "merge"—that is, a version of Unix that will run programs written for Microsoft's Xenix (both the 286 and the 386 versions) plus programs written for 386/IX, plus MS-DOS programs. The likely result will be a single, standard, SVID-certified Unix for all 386-based computers, with binary-code compatibility. In other words, programs written for one 386-based system will run on other vendors' 386-based systems without a porting effort and without recompiling. If this happens, it will constitute a small miracle—for the Unix world, anyway—and a major coup for Intel, which has been promoting such unification.

Interactive Systems expects to have the merged version ready in the first quarter of 1988, in time to compete with OS/2, says Heinz Lycklama, senior vice president of technology at the company and a member of the Posix committee. Although the merged 386 Unix will be based on System V, "we have added some Berkeley features to it," Lycklama says. Other Unix ports are available for 386 machines, but vendors of 386-based systems are very likely to migrate to the merged version, says HCR's Tilson. That means the 386-system community should have a unified approach to Unix inside of about one year, he believes. As a result, "the 386 stands to be the highest-volume Unix platform of them all," he says.

Tilson contrasts the 386 Unix situation with that surrounding Motorola Inc.'s 68020 microprocessor. There are many versions of Unix for the 68020; no one has made an effort to pull them together to make a standard. "There's a lot of variety, and no binary compatibility," he says, "which is kind of silly, since they're all running on the same processor."

OS/2, the much-ballyhooed multitasking operating system for 386-based machines, may lose a big piece of market share to Unix. OS/2 is late, and the merged 386 Unix will be on the market as OS/2 arrives toward the middle of 1988.

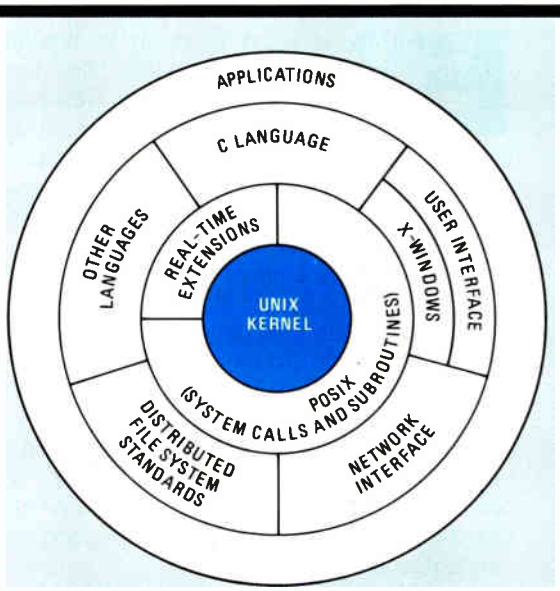
There are already many applications that run under Unix, and applications for OS/2 may be some time coming. Both will run MS-DOS programs, but only Unix offers users the multiuser option. "You could have 10 MS-DOS applications running at once, as well as Unix applications. Something like that has the potential of short-circuiting OS/2," says Tom Greene, research-and-development manager at Apollo Computer Inc., Chelmsford, Mass. OS/2 suffered another blow recently when IBM itself announced plans to offer Unix for its 386-based PS/2 Model 80, to bring it in line with software standards for the technical work station market.

Some feel, however, that OS/2 and Unix could settle into different segments of the market. "Unix is the best solution for multiuser systems," says an executive at Milan-based Olivetti. "There's no competition between MS-DOS and OS/2 on the one hand and Unix on the other because MS-DOS, and probably OS/2, will be standard for single-user PCs and Unix for servers, minicomputer engines, and high-end work stations."

A standard for Unix that applies across many architectures, however, will take more time. "Unix has the potential of becoming a good standard," says Barbara Shelhoss, Apollo Computer's senior product manager for Unix. "The incompatibilities will eventually be worked out. The work the IEEE is doing on developing a vendor-independent standard is very important."

Ultimately, if the industry cannot present the user community with a standard Unix, the users

UNIX SPAWNS OTHER STANDARDS



themselves will choose a standard. And a user-driven trend is emerging, a trend that can be seen in the actions of the Air Force. It recently issued a request for proposals for a huge contract: some 22,000 Unix-based departmental systems worth about $3 billion.

The Air Force specified that the systems should be SVID-certified, with the provision that the vendor migrate to Posix compatibility when that standard matures sufficiently. Other major users, such as General Motors Corp., have set up similar requirements. All want a standard controlled by an industry body instead of one company, but they also see that Posix is not quite ready yet. □

Additional reporting by Paul Angiolillo, Lawrence Curran, John Gosch, and Jonah McLeod

UNIX: A BIG EUROPEAN PUSH

Europe's computer industry is way out in front of the Americans in embracing Unix, thanks to its push for open systems; almost all major makers offer Unix-based systems

by John Gosch

Europe is wholeheartedly embracing Unix. Moving at a far faster pace than their American counterparts, European computer makers are pushing to establish the operating system that AT&T Bell Laboratories developed 17 years ago as the key component in their drive toward open-system computing.

Almost all the major European computer makers are fielding Unix-based systems, a fact reflected by the surging Unix market. The growth tends to be uneven, since some obstacles still remain to widespread use of Unix in mainframes, personal computers, and real-time systems, among others. Nevertheless, the growth of Unix seems sure to continue (see chart, below), because establishing it as a standard is in the best interests of virtually the entire data-processing community—users, hardware vendors, and software vendors.

Users like Unix as a standard because it promotes portability in software. That means they aren't tied to any particular vendor—they can buy the best hardware for their particular purposes. Software vendors' interests converge neatly with those of users. They can write one version of an application and sell it to anyone with a Unix-based system, instead of adapting each application to a host of different proprietary operating systems.

For hardware vendors, a Unix standard promotes connectivity—it makes it much easier for them to link different machines. What is more important, though, is that promoting software portability and connectivity—in effect, establishing that all hardware is created equal—makes a Unix standard a potent weapon against dominance by IBM Corp.

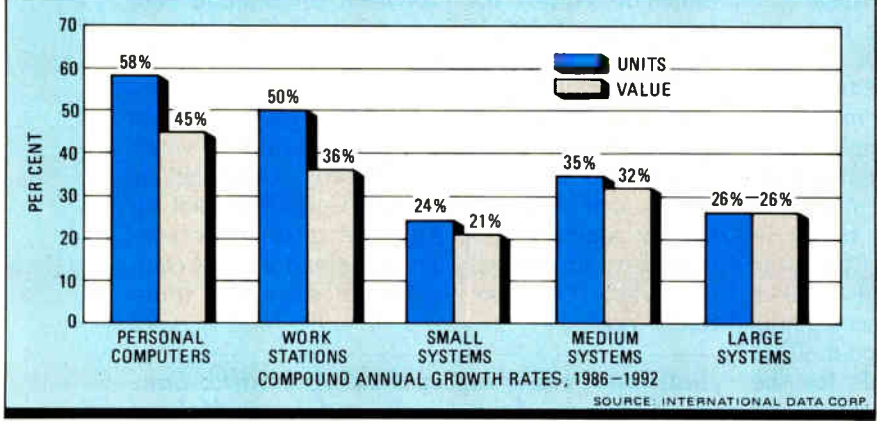
It was largely to combat IBM that European, and some American, hardware vendors originally established the X/Open Group [*Electronics*, July 10, 1986, p. 121], which has since become the X/Open Co. This organization has been working to establish a standard version of Unix, along with several related standards—notably one for a programming interface that is based on the IEEE standard, Posix.

X/Open's efforts have, of course, also served to promote more widespread use of Unix. Combined with the various other factors that are pushing Unix, the results have been phenomenal. "The Unix market virtually exploded last year," says Friedrich Dischinger, a market researcher in the Data Systems Division of Siemens AG in Munich. Analysts at market research firms such as Inteco in London and International Data Corp. in Paris put the number of Unix systems delivered in Western Europe in 1986 at around 50,000—an increase of some 120% over the previous year.

Support for Unix has been greatest in two areas: small- and medium-size multiuser systems with from 4 to 16 terminals, and single-user work stations for engineering applications, including computer-aided design, says Klaus Gewald, executive director in the Data Systems Division of Siemens. In work stations alone, Unix shipments grew by 150%, according to Siemens's market researchers.

Virtually all the computer companies in Western Europe are committed to Unix. Siemens, for example, by mid-1987 had delivered more

UNIX'S HEALTHY FUTURE IN EUROPE



than 16,000 of its MX Series Sinix machines in Europe since the end of 1982, the year it began to offer Sinix, which is the West German company's version of Unix. That number makes the company Europe's leader in the Unix world.

Nixdorf Computer AG is also shaping up as a strong Unix contender. With its Unix-based Targon family of supermicros, superminis, and multicomputer and fault-tolerant systems, the West German company is demonstrating that Unix can be extended into bigger systems. Nixdorf has installed 250 of its Targon models during the past two years, which is just the beginning. "By the end of this year we expect to have 1,000 of them in place," says Hermann Johannes, product marketing manager for the Targon family.

Philips in the Netherlands is on the Unix scene, too. The company has installed about 500 of its Unix-based P9000 family of minicomputers, which are servers or departmental processors. "We expect to do around $700 million worth of business with the P9000 per year by 1990," says Gerd Bindels, senior managing director of Philips's Telecommunications and Data Systems Division.

SOME OBSTACLES REMAIN

However, Unix has not gained ground everywhere. Relatively few mainframes run Unix because "mainframe operating systems offer much more than Unix can," says John Totman, Unix product manager for ICL plc in Bracknell, UK. In addition, Siemens's Gewald notes that "AT&T originally devised Unix with minicomputers in mind. It would require big investments to adapt it to large mainframes."

At the other end of the spectrum, Unix has not yet entered the established single-user personal-computer environment, largely because it was developed mainly for multiuser systems. In that market, the MS-DOS operating system predominates. Similarly, the multiuser orientation makes Unix unsuitable for real-time systems. For example, Force Computers GmbH in Ottobrunn, West Germany, which sells board-level computers primarily for real-time applications, supplies Unix only for software development for its target systems.

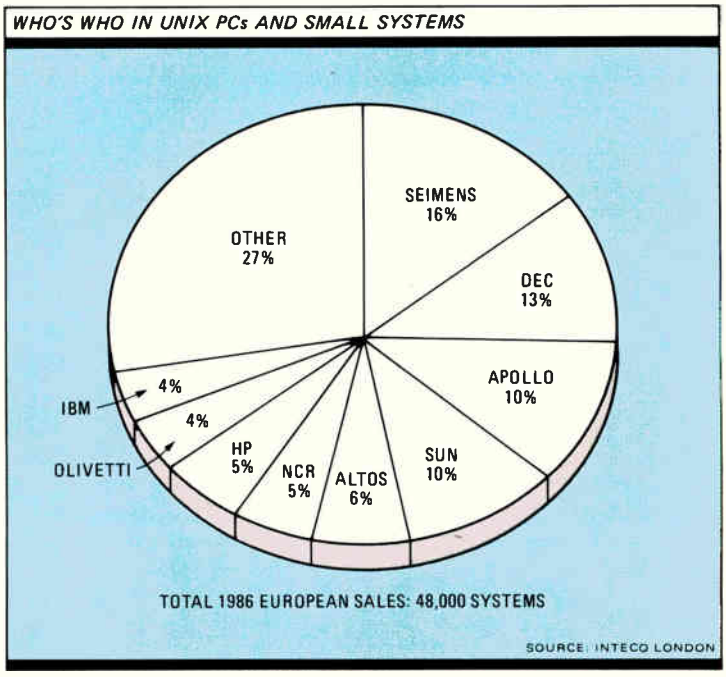
Other factors are also inhibiting Unix's growth. Gewald points out that when older operating systems do well on the market, companies are reluctant to push Unix. Also, defining a formal standard is in the hands of several different standards organizations, says Vesa Kousa, a product manager in the Information System Division of Finland's Nokia Group. "These organizations are working so slowly that development is passing them by," he says.

None of these obstacles is insurmountable. Unix is likely to spread further, faster. For one thing, "users are making it known that Unix would suit them best as a standard," says Totman at ICL. Gewald, at Siemens, agrees. The reason is that Unix "gives them the freedom to switch to different suppliers and different hardware." It facilitates the portability of applications software, so users can employ programs written by a variety of software producers, including third-party software. These advantages, Gewald says, are the primary reasons for Unix's success so far.

For a software company, a standard like Unix reduces the cost of research, development, marketing, and support. And as Heinz Diehl, a technical manager at Nixdorf, points out: "It also provides such companies with greater access to new marketing channels and hardware markets."

For a hardware company, says Totman at ICL, a standard such as Unix is required to tie midrange computers to personal work stations and mainframes. And such connectivity is vital: "In the future, markets will be dominated by the need for departmental computing, which will in turn demand applications portability at the source-code level as well as transparent networking among minis, from minis to personal terminals and desktops, and to mainframes—from MS-DOS through to top-range mainframes," he says.

"ICL sees the adoption of a standard operating-system interface as an integral part of the Open Systems Interconnection concept, where each node in a network should be able to support a standard application, irrespective of the architecture of the hardware in use," Totman says. "This would create a free and open market for applications and lead to a fully integrated market for hardware and software." He adds that Unix is not necessarily the best system technically to create this open environment—but it is available, it does the job, and its use is already widespread.



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CHIPS & TECHNOLOGIES PLUGS INTO IBM'S MICRO CHANNEL

The PC-clone chip maker's three interface chips will enable adapter-card makers to add features to IBM's PS/2; an expanded chip set will make PS/2 clones possible

by Bernard C. Cole

When IBM announced its PS/2 series of personal computers earlier this year, PC-clone makers as well as their chip suppliers were quick to say they didn't expect to encounter any significant problems in coming up with their own versions of the PS families or the chips that made that possible. But they made that claim before they took a good look at the Micro Channel, IBM's new expansion bus for PS/2 models 50, 60, and 80. On the face of it, Micro Channel seems to be totally incompatible with the IBM PC and PC/AT buses.

That didn't daunt Chips & Technologies Inc., the young upstart supplier of about 80% of the chips that have allowed clone manufacturers to take away big shares of the PC markets from IBM Corp. Now the San Jose, Calif., company is going to try to repeat history with the PS/2. This month, Chips & Technologies (see p. 77) will introduce the first in a family of Micro Channel adapter circuits that it calls the MicroChips family.

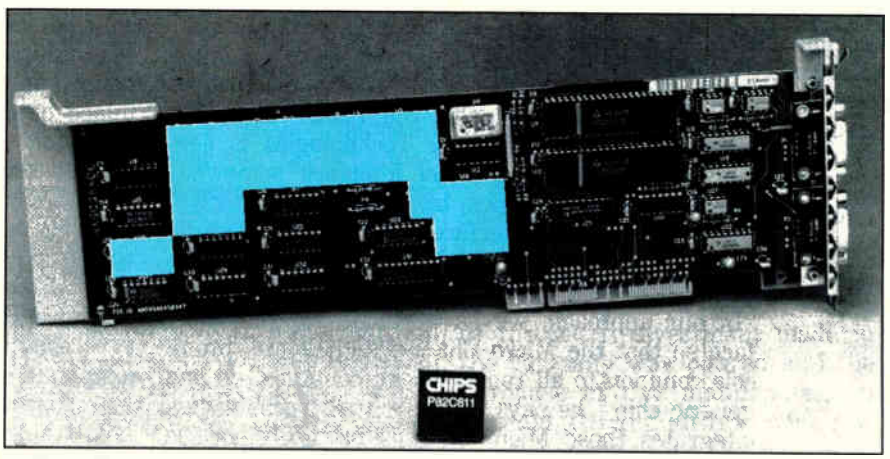
To begin with, Chips & Technologies will offer these first three chips to equipment makers supplying adapter and accelerator boards and cards. But early next year, the company will use these chips along with additional members of the MicroChips family to build versions of the PS/2 models 50, 60, and 80 motherboards that it will sell to clone makers.

The MicroChips family initially will include generic and function-specific chips that will interface with the PS/2's asynchronous bus. With these chips, adapter- and accelerator-board manufacturers will be able to supply products that add features and capabilities not incorporated in the IBM computers, ranging all the way from additional memory and input/output channels to accelerator boards that boost performance. Each of these requires a different level of Micro Channel support.

Initially there will be three standard versions of MicroChips: the 82C611 (see fig. 1), the 82C612, and the 82C613, all fabricated in 1.5-μm double-metal CMOS. The 82C611 is aimed at the memory, I/O, and multifunction adapter-card markets, says Raj Jaswa, senior product marketing engineer at Chips & Technologies. It is designed to support up to four I/O relocations and one memory relocation. Aimed at use on peripheral-control adapter cards for the PS/2, the 82C612 can support two I/O relocations and one memory relocation. Both parts will be available in sample quantities in late October and in production quantities in November. Available in the first quarter of 1988, the 82C613 is aimed at coprocessor and high-performance adapters. It will support up to two I/O relocations and one memory relocation.

Along with the standard versions, there will be application-specific MicroChips customized for very high-volume applications. For example, scheduled for introduction later in the year is the 82C574, a custom MicroChip that complements Chips & Technologies' new 82C570 single-chip implementation of IBM's 3270 terminal protocol.

On the face of it, the Micro Channel architecture represents a radical departure from the basic PC and PC/AT. The most significant departure is the fact that bus transfers on the Micro Channel are asynchronous, versus the synchronous scheme used in the PC, XT, and AT designs. "For us, this is less of a problem than most other chip manufacturers targeting the PC market, since very early in



1. SPACE SAVER. Chips & Technologies' 82C611, designed to interface with the Micro Channel in the new IBM Personal System/2, replaces 10 separate chips on this adapter card.

And even with a number of competitors getting into the market—Faraday Electronics, LSI Logic,

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the Amdahl or the IBM mainframes. *–B. C. C.*

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TECHNOLOGY OUTLOOK

THE DRIVING FORCE: THE INSATIABLE DEMAND FOR INFORMATION

On almost every technology front, the driving force behind new developments is the ever-rising demand for information. Huge amounts of data and information, larger than anyone ever dreamed of a generation ago, have to move faster and faster through processors and networks, then end up having to be stored. To accomplish this titanic task, semiconductor technology is moving ever faster toward speedier, more powerful processors and denser, more complex logic chips to manipulate this information. Memories must keep expanding in capacity to store this information, as well as to reduce the time that it takes to access it. Architectures are getting restructured to speed the execution of instructions to process it. And networks are quickly expanding and getting smarter so users everywhere can share this information.

The engineers and designers behind this revolution need information, too—and they are profiting from the advances in information technology. They sit at powerful work stations with high-resolution graphics, quickly designing and laying out complex chips and multilayer printed-circuit boards. They can mix or match vast libraries of proven functional block designs. Sophisticated computer-aided-design tools offer advice and guidance, so users can simulate designs in real time before they're implemented, then move them into production faster because prototypes usually work the first time. High-performance instruments acquire and manipulate test data, while monitoring production for any signs of trouble. Meanwhile, at the factory, information links the production line, the front office, and the customer.

For now, it's hard to see any slowdown coming in the demand for more information; it's also hard to foresee a slowdown in the rate of technology change.

Contents

Corp., the Littleton, Mass., manufacturer of minisupercomputers for the server tier. "As a consequence, the instruction set of a processor will fade as an issue," says Thinking Machines' Hillis. "Today, the first thing people ask about a processor is [what is] the instruction set; it will become the last thing they ask."

One example of network computing is Apollo's Open Dialogue network-management and user-interface software, which allows user interfaces to be developed and adapted to personal-computer and workstation platforms from major vendors. "Work stations from those vendors now encompass the Unix, VMS, and MS/DOS operating systems," Apollo's Nelson says. "Open Dialogue allows a user to construct an application that runs across all of them at once and on only one of them at another time. So we're evolving a concept of an application that is a dynamic animal that can be spread across different machines and operating systems."

Alliant's Mundie points out that seamless integration is coming between personal computers and the server-level machines. For example, Sun and Apollo work stations and PCs now plug into an Ethernet, and the files of all of them can reside on an Alliant system that is driving a graphics output in a PC window. "We've never had that tight a coupling before," he says. Mundie says that a good prototype for the interconnected three-tiered system exists at the National Center for Supercomputer Applications at the University of Illinois at Champaign-Urbana. That installation, called the advanced-visualization facility, links various work stations at the lowest level with an Alliant FX/8 server system, several graphics and image coprocessors and film recorders in the middle, and a Cray X-MP/48 supercomputer at the top tier.

"An important area needing improvement is the way graphics data is visualized on the screen," says Stellar's Poduska. This is an area that his company is addressing, although he will not tip his hand as to how. "We need to render surfaces better on the screen so that engineers can see, for example, the edge of a turbine blade and how it might be flawed by high temperatures, so that they can build a better blade. It takes a lot of computing power, input/output capacity, and strong graphics capability to show the engineer what the data means—which is what computing is all about."

There will be two main developments in high-performance graphics in the coming year or two, predicts Louis Doctor, president of Raster Technologies Inc. in Westford, Mass. "The fastest systems will get faster, and cheap systems cheaper—but the fast ones won't necessarily get cheaper," he says. "For roughly the same amount of money, there will be dramatic improvements in high-performance 3-d graphics—by at least a power of 10 and probably more like 100 in horsepower... Today's systems are nowhere near fast enough to interact with the complex models needed for today's simulations and analysis." *–Tom Manuel*

Additional reporting by Larry Curran and Paul Angiolillo

SOFTWARE

A BATTLE OVER OPERATING SYSTEMS

The world of software technology usually moves slowly, improving functionality here, reliability there, taking one small step at a time along the paths of long-term trends. But next year, at least one set of events is certain to stir up action in the software community. Two operating-system environments are set to arrive that cut loose the minicomputer power of the Intel 80386 microprocessor: OS/2 from Microsoft Corp. and IBM Corp., and a standard version of Unix. A battle for market share is likely to ensue, involving not only OS/2 and Unix, but also their associated windowing systems, the Presentation Manager and X-Windows.

Coming Soon

- OS/2, IBM's long-awaited operating system tailored to Intel's 80386 32-bit chip
- Compiler systems that bring many high-level languages to a new computer—quickly

On another front, recent trends in computer architecture toward both parallel and reduced-instruction-set computers depend heavily on developments in languages and compiler technology to make good their high-performance promise. Advances in the ability of compilers to optimize the performance of application programs will be seen next year.

The 386 microprocessor from Intel Corp., Santa Clara, Calif., holds out big performance promises that are not yet being realized. Current 386-based personal computers are running applications written for the MS-DOS environment, essentially acting as fast 8086 processors. But MS-DOS only allows 640 Kbytes of address space for each program; the 386 is awaiting far more ambitious applications under OS/2 and Unix that can make use of its 4-gigabyte logical address space.

OS/2 is late and getting later. Originally slated for delivery at the beginning of 1988, it is now estimated to arrive toward the middle of the year. But Microsoft and IBM can't afford to hold up OS/2 for long, because a standard Unix System V for the 386 is due

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pattern-recognition algorithm, the processor is designed to recognize vocabularies that include digits, along with many typical word-processing commands.

Other significant efforts include a compiled chip set for specialized graphics computations from General Electric Co.'s Corporate Research and Development Center in Schnectady, N. Y.; a cosine transform processor from MIT's Lincoln Laboratory in Lexington, Mass.; a pipeline-sorting chip from NTT in Tokyo; and a character string-search processor from NEC Corp., also in Tokyo. All are still in the R&D stage.

In addition, a variety of specialized processors should start to emerge into the marketplace during the coming year. Among the semiconductor makers currently investigating such offerings are AMD, Intel, LSI Logic, National Semiconductor, Texas Instruments, and VLSI Technology. If algorithm-specific devices are still in the toddler stage, RISC microprocessors are maturing into scrappy adolescence. According to Lyle Pittroff, director of strategic development for processor products at AMD in Santa Clara, Calif., a battle royal over RISC is building up in the 32-bit marketplace that will erupt in earnest during the coming year. The opposing forces will be set in motion by the introduction of RISC architectures from a number of semiconductor houses, including AMD, with its Am29000, Intel Corp., and Motorola Inc. A wild card is the possibility of a second Clipper chip, which may be introduced by the Clipper's new owners, Intergraph Corp., should that company follow the intentions of Clipper's original developers, Fairchild Semiconductor, to keep the chip evolving.

With the addition of these new RISC chips, the 32-bit marketplace will begin to segment itself into a low-to-medium performance range and a high-performance range, with the dividing line at about 8 to 10 million instructions per second, says Paul Chu, manager of product planning at AMD. RISC machines will dominate in applications where performance, rather than compatibility with existing software, is key, he says. Below the dividing line, traditional complex-instruction-set computers based on Intel's 386, National's 32000, and Motorola's 68000, will continue to dominate, he predicts.

However, says Chu, the CISC machines of tomorrow will in many respects bear more relationship to their RISC competitors than to their earlier CISC predecessors. "In order to squeeze as much performance out of their designs as possible, the new CISC machines will incorporate features, such as on-chip cache, that are traditionally associated with RISC machines," he says. "However, in the most important areas, such as instruction complexity and the number of machine cycles to execute an instruction, there will continue to be a wide gulf." *–Bernard C. Cole*

CAD/CAE

NEW TOOLS WILL BREAK DESIGN BOTTLENECKS

As pervasive as it is becoming, computer-aided design and engineering is still hobbled by several problems. But help is on the way, and a growing number of solutions will become available in products next year. Design tools that are emerging are smarter, able to handle analog as well as digital signals, and can help speed up the development of test programs.

New tools will be able to tell designers how to improve a design before it gets implemented in silicon or on a printed-circuit board. Some design tools are beginning to take advantage of artificial intelligence—they predict die size and power consumption; others automatically reduce the amount of logic in a circuit at the schematic entry stage of design. Expert systems will also critique a schematic and netlist, telling the designer where the circuit can be improved.

Coming Soon

- Interactive adviser tools that will help to optimize designs before implementation
- Analog and mixed-signal simulators to break a major bottleneck in system design
- On-chip circuits for testing all of the nodes on complex application-specific ICs
- New tools that eliminate the need for or speed up exhaustive fault simulation

New simulators for analog circuits and mixed-signal simulators that test both analog and digital circuits will become more common and more capable. They will help break one bottleneck in total system design: analog-circuit simulation. The new analog simulators will provide the reliability and accuracy lacking in the Spice simulator, the public-domain package that by default has become virtually a standard for analog design. And they will enable higher-level behavioral models of analog circuits just as there already are for digital. This is especially critical now because of the plethora of new designs containing analog circuits. Similarly, the new mixed-signal simulators will handle the designs that combine analog and digital circuitry.

CAE tools are also coming that should help break another serious bottleneck in the overall design process: the difficulty in producing test programs as

improve their overall designs. The Design Adviser [*Electronics*, June 25, 1987, p. 31], an expert system from NCR Corp. of Ft. Collins, Colo., provides specific counsel on improving performance, testability, and manufacturing yield.

Next year, designers can expect to see competitive packages and enhancements for the current capability. "Designers can expect to have software to suggest better ways to simulate their circuit," says Robin L. Steele, NCR's senior principal engineer for the product. "For example, certain state machines should be simulated on both edges of a clock to determine if problems are created when the clock shifts phases."

The industry can also expect tools to provide advice on better implementation of circuit function. But the job of the tool suppliers will be difficult, because the kind of expert system needed to advise on how to make a better circuit function faces the problem of understanding what a circuit is supposed to do, working only from the information it can derive from a netlist. "For example, software can be written that can analyze a circuit and recognize a bank of flip-flops and NAND gates and deduce from this that it has come upon a counter," says Steele. "But what kind of counter is it—a ripple counter, an up/down counter?"

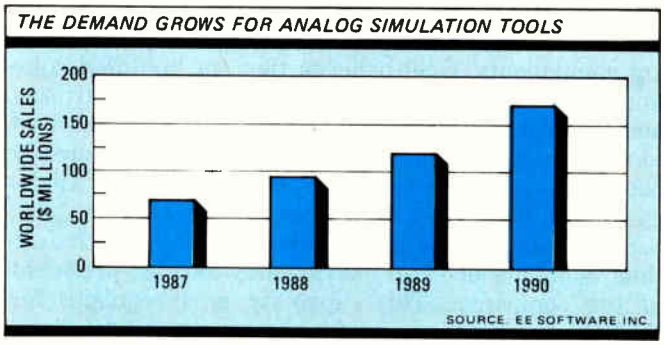
NEW SOFTWARE IS NEEDED

The software can't make this kind of decision by examining connectivity and circuit components. "New heuristics need to be developed to help make this determination," Steele says. "We could ask the designer to explain to the software what kind of counter it is, but we're trying to minimize the amount of work the designer must perform to achieve the analysis. The other side of this problem, of course, is that if you ask the designer, he may be mistaken, so it is best for the tool to extract the information itself."

Projects are under way at NCR to develop expert systems that can help devise a heuristic procedure for partitioning a design in preplanning a layout. One such project at NCR may be combined with the Design Adviser, according to Daniel Ellsworth, NCR's manager of advanced development strategy. "With each new generation of tools and process technology there is a limit where the state of the art in tools breaks down, and a large design has to be broken down into smaller units that the tools can handle," Ellsworth says. "That is when a tool to improve partitioning becomes important."

Performance evaluation and improvement is another aspect of the design process needing expert help. Already available is the capability of making speed and area tradeoffs for buffering and excessive fan-out. This capability draws on a technique called logic-chain analysis and local transformation, in which the tool analyzes a collection of logic circuits—a logic chain—and suggests changes to them—a local transformation—that improve their design. For example, it might tell the designer a gate in the design might need higher output current drivers to provide a better signal level to the gates it drives.

Tools to perform logic minimization are available from companies such as Optimal Solutions Inc., the



General Electric Co. spinoff in Research Triangle Park, N. C., and VLSI Technologies. Future generations of tools, however, will be more extensive in their capability. They will probably resemble the intelligent compiler introduced by Silicon Compiler Systems Corp. of San Jose, Calif. [*Electronics*, April 30, 1987, p. 54]. "While logic-minimization tools attempt to optimize a design for one of two variables (speed and area), an intelligent tool will optimize a design for functional, performance, and physical-layout constraints set by the designer," says Philip Kaufman, chairman and chief executive officer at SCSC.

While tool suppliers have been raising the intelligence of tools to perform digital design, they have not built equally powerful tools—especially analog simulators—for mixed analog and digital circuit design. By 1990, 39% of semicustom designs will have analog functions, according to Cindy Thames at the Technology Research Group. Moreover, the analog simulation market is no small niche either. The total analog simulation market for 1987 will be about $65 million, with projected growth to $80 million in 1988, $120 million in 1989, $170 million in 1990, and $210 million in 1991, says Kevin Walsh, vice president of marketing at Electrical Engineering Software, a San Jose, Calif., company that offers an analog simulator. Furthermore, he says that only 10% of CAE work stations are currently using analog design tools.

"The product everyone in this market is waiting for is a true mixed-signal analog and digital simulator," says Walsh. Most tools for mixed circuits actually use dual simulators. For example, Viewlogic Systems Inc. of Marlboro, Mass., uses its own 28-state logic simulator, Viewsim, to perform digital simulation, and uses the PSpice analog simulator from MicroSim Corp. of Laguna Hills, Calif., to simulate analog components. The two tools work concurrently. Sierra Semiconductor Corp. of San Jose, Calif., was heralded as having the first behavioral simulator to allow both analog and digital functions on an IC to be simulated together [*Electronics*, October 16, 1986, p. 60].

"The problem with mixed-signal simulation is that it combines a logic simulator with a Spice simulator," says Prabhu Goel, president and chief executive officer of Gateway Design Automation Corp. of Westford, Mass. "Spice is too slow to perform significant mixed-mode simulation." The limited mixed-mode simulation today cannot handle components more complex than digital-to-analog converter, analog-to-digital converters, operational amplifiers, comparators, and

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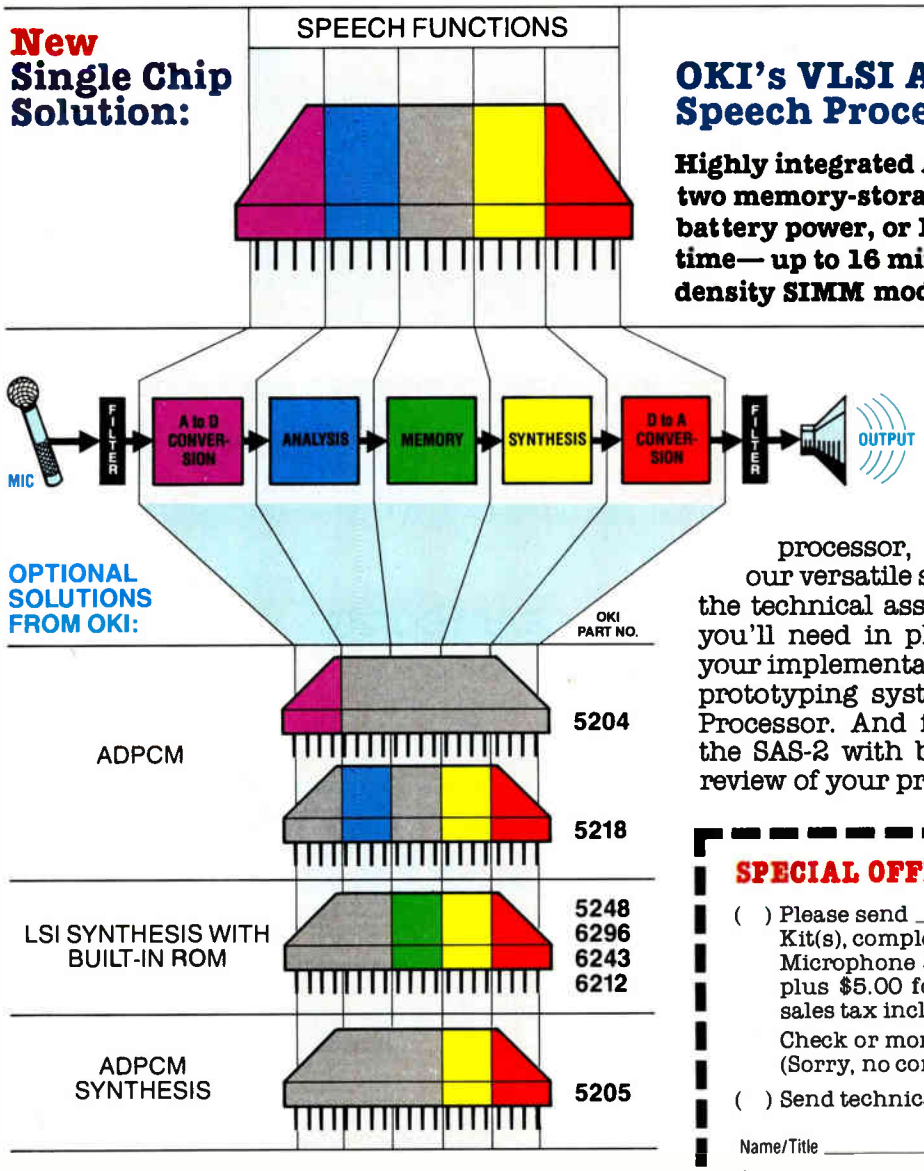

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TEST & MEASUREMENT

THE DIGITAL TAKEOVER PICKS UP SPEED

In test and measuring equipment, changes aren't as sweeping as those shaping semiconductors and computers. But the factors that affect instruments are numerous and complex, and the results, although taking longer to arrive, are no less dramatic.

Changing technology is one key force, most notably in the inexorable shift to digital instruments. Changing test requirements are another crucial factor, one affecting every application area. In fields ranging from research, design, and development to manufacturing, engineers are turning to computer-automated testing and to automated measurements so they can handle the voluminous data being generated.

Coming Soon

- A lot more digital instruments, including oscilloscopes with bandwidths better than 20 GHz
- Tools that can test chips and boards, as well as systems that link engineering to manufacturing
- Computer-aided testers that can find faults in designs, components, or processes

There is a growing demand in almost all testing segments for greater functionality, ease of use, and increased modularity. This move is feeding a drive for standardization, at least in buses, as the capabilities of test and measurement equipment diversify: more and more functionality is being added, and at the same time ATE gear is becoming more narrowly focused, growing more application-specific.

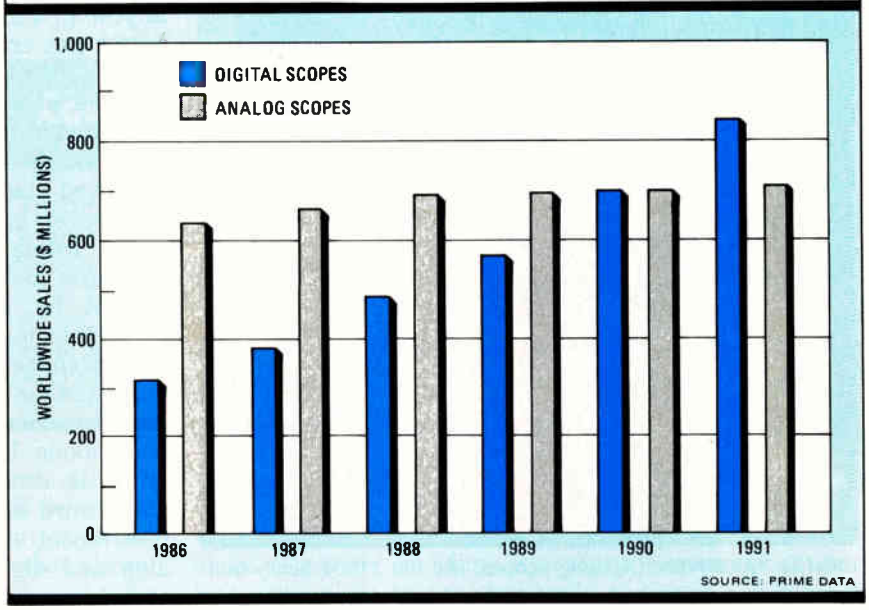
If there is one word that touches all test bases, it is "digital." All the classical measuring instruments—oscilloscopes, multimeters, signal sources—went digital long ago. Analog instruments still dominate in sheer numbers, offer the best performance in most measuring categories, and carry lower price tags, but that will soon change. Galin Wampeter, president of Prime Data, a market-research firm in San Jose, Calif., says that sales of digital scopes, for example, are growing at a 22% rate, compared with only 2% for analog and 10% for instruments in general. By 1991, digital scopes will hold the larger share of the market for the first time (see chart). Digital performance is gaining, too. The analog scope is holding at 1-GHz best bandwidth; the digital version has hit 20 GHz, and keeps climbing.

The shift to digital is caught up in the movement toward computer-aided engineering and manufacturing. Engineers working on CAE systems need to simulate and verify their designs. For that purpose, digital instrumentation is a natural. Reduced to essentials, CAE designs are little more than logic 1s and 0s—fodder for equipment like the new Tektronix DAS 9200 digital analysis system or Hewlett-Packard Co.'s 16500A logic analysis system. Both of these can tackle chips, boards, or systems, and both can close the design loop, linking engineering and manufacturing.

The net benefit of such digital instrumentation is productivity. Design time gets shorter. The first design works—at least, that's the goal—so chips and boards get to manufacturing sooner. With CAE-to-ATE links, products get tested better and faster. Better-quality products reach the market faster and cost less.

The push to digital is related to the equally strong drive for computer-aided testing, a subset of computer-integrated manufacturing. "Manufacturing is the hottest test area today, with the greatest needs and the biggest shifts," says Frank Hermance, general manager for laboratory instruments at Tektronix Inc. in Beaverton, Ore. And that's particularly true in the U.S., says John Battin, president and chief operating officer of

DIGITAL OSCILLOSCOPES ARE TAKING OVER



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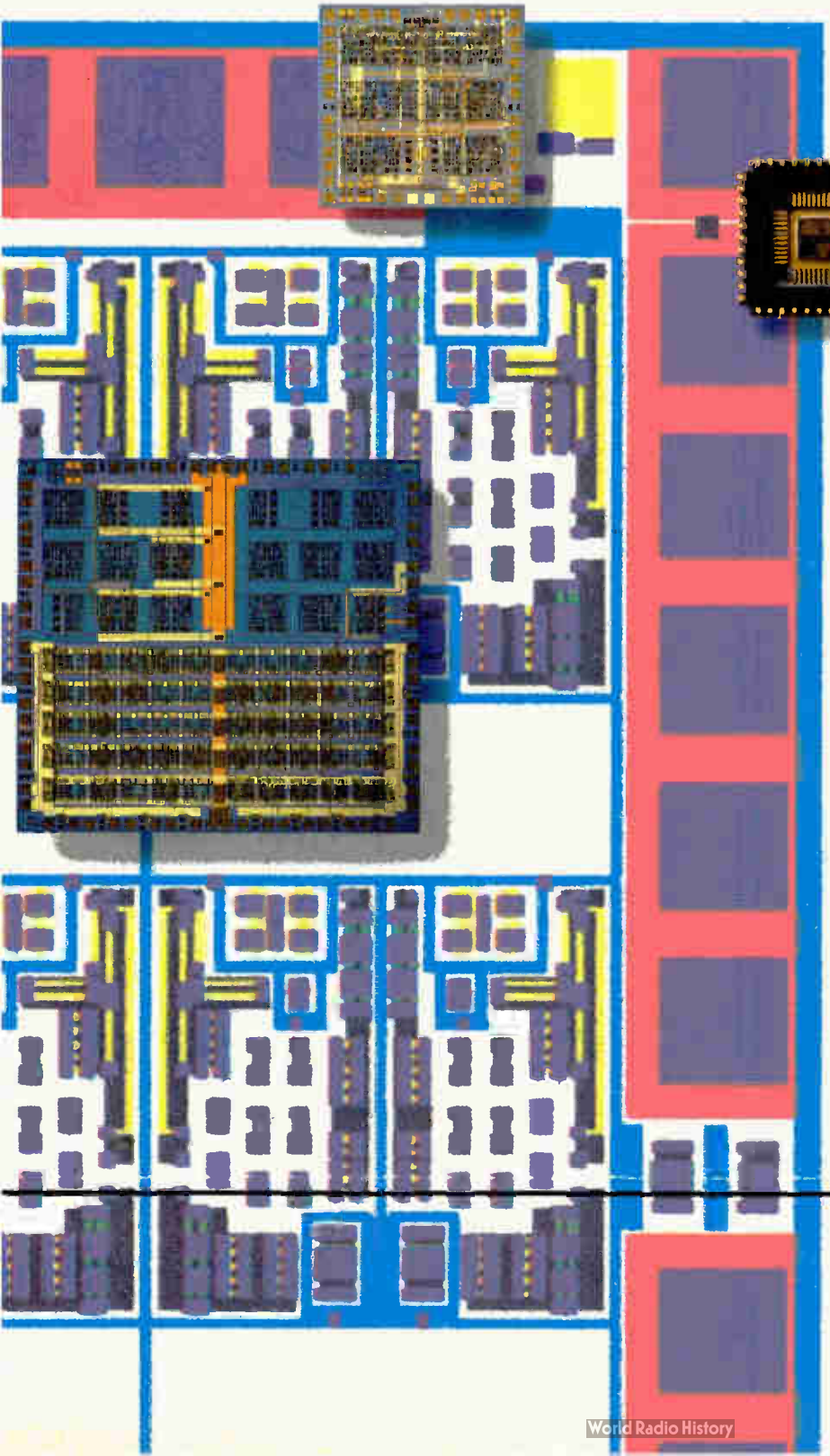

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NUMBER 138

DIGITALIZATION EXPANDS IN LATIN AMERICA.

In keeping with the ultimate goal of a global ISDN, telecom authorities in Latin America are stepping up their digital network programs.

Telecomunicações Brasileiras S.A. recently awarded NEC do Brasil S.A. a giant order for state-of-the-art digital equipment. It includes NEAX61 digital switching systems (360,000 lines), 5GHz 140M-bit digital microwave communication equipment (1,800 sets), fiber optic communication equipment (200 sets) and PCM transmission equipment (1,300 sets). Most of the systems are to be produced locally with delivery starting this year.

Meanwhile, Empresa Nacional de Telecomunicaciones, Argentina has awarded PECOM-NEC S.A. a contract for NEAX61 digital switches (300,000 lines) and PCM transmission equipment to be installed in the metropolitan and northern areas of Argentina. Local production is scheduled to begin soon. In 1982 NEC constructed a 320-km fiber optic digital telephone system, interconnecting 6 tandem exchanges and 60 telephone offices in the metropolitan area.

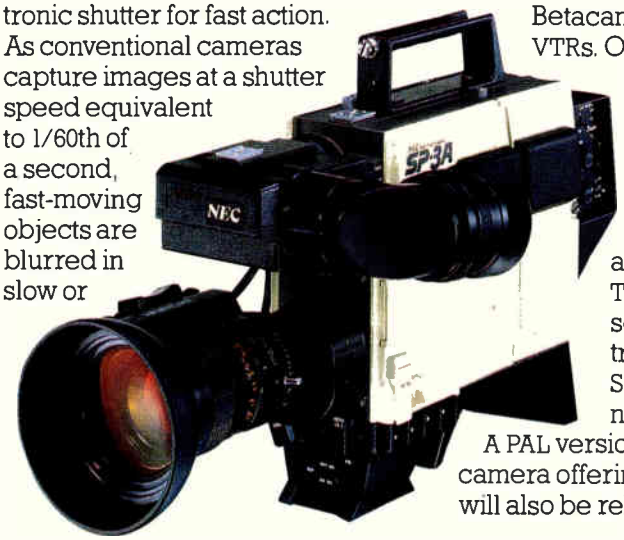
NEC is also contributing to the 5-year telecom digitalization project by Compañía Anónima Nacional Teléfonos de Venezuela by supplying NEAX61 digital switches to 97 exchanges in Maracaibo, Puerto La Cruz, and other important areas. For interconnection of these exchanges NEC will supply a 200-km fiber optic communication system.

As one of the world's leading suppliers of digital exchanges, microwave and fiber optic systems, NEC is helping to further the digital revolution throughout the world.

NEW CCD CAMERA STOPS ACTION ELECTRONICALLY.

The trend in color cameras for broadcast use is irrevocably "solid-state". CCD cameras are more compact, dependable and durable than tube types and have no comet tails and burn-in when shooting extremely bright objects.

On top of these inherent benefits, NEC's new SP-3A CCD Color Camera has an exclusive feature—the electronic shutter for fast action. As conventional cameras capture images at a shutter speed equivalent to 1/60th of a second, fast-moving objects are blurred in slow or still playback on VTR. To remedy this problem, our SP-3A stops the action electronically at 1/60th to 1/2000th of a second, offering precise, clear-cut images.



The SP-3A uses 3 new CCD chips that are anti-smear and -blooming—two for the green channel and one for the combined red/blue channel. This dual green system provides much higher resolution and sensitivity than the conventionally-structured RGB system.

The new CCD camera displays widespread versatility. Besides standalone use it forms an efficient shoot/record system with integral Betacam, MII or 8mm-format VTRs. Options are available for multi-core or triax remote control.

Users' acceptance of this versatile new camera has been remarkable. NBC, a major U.S. TV network, recently sealed a five-year contract to purchase the SP-3A for electronic news gathering.

A PAL version of NEC's CCD color camera offering broadcast quality will also be released.

WORLD'S FASTEST ECL GATE ARRAYS.

The performance of high-speed silicon logic LSIs is rapidly accelerating. NEC's new ECL-4 gate arrays are the swiftest in the world with a 100ps basic gate delay or 220ps fully loaded.

Combining unprecedented speed and flexibility, the ECL-4 family includes the μPB6312 with 1,200 gates (400 Full-adders) and the μPB6303 with 600 gates (200 Full-adders). Both offer 100K or 10KH interface options and ample I/O up to 108 pins.

NEC's ECL-4 gate arrays are available in a choice of 72- or 132-pin PGA packages, and operate in ordinary forced-air-cooling environments since sophisticated heat sinks are standard.

NEC offers 61 internal macros and 33 I/O blocks plus complete CAD tools. The ECL-4 family should hasten the development of speed-oriented computers, graphic terminals, LSI testers and telecom equipment.

NEC

TELECOMMUNICATIONS

SATISFYING THE NEED FOR MORE BANDWIDTH

The telecommunications industry is working toward the advent of the integrated services digital network, the plan to replace the world's analog telephone network with an all-digital net. But until that day arrives—in five years or so—the task is to meet consumer demands for ever more bandwidth. In the coming year, phone companies in the U.S. will be largely relying on the fast-growing T1 and T3 services to meet that goal.

Coming Soon

- Broadband ISDN that will provide business and home users a host of new services
- Bandwidth requirements that will force vast amounts of rewiring with fiber-optic cable

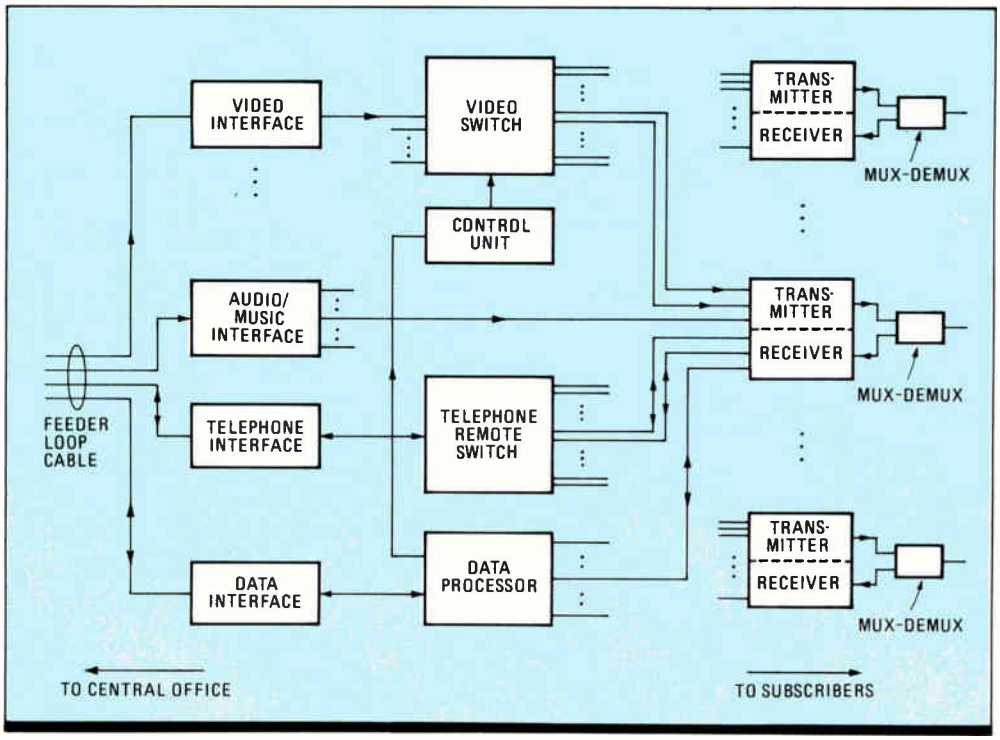
The 1.536-Mbits/s T1 communications link is increasingly popular, especially now that its cost is competitive with the 64-Kbit/s T0 link. Next year industry analysts expect a run on T3, which operates at 44.746 Mbits/s and can therefore provide more voice- and data-communications links. Telephone companies are expected to spend $600 million on T1 and T3 installation by 1990, up from $150 million this year, according to Probe Research Inc. in Morristown, N.J.

"Phone companies sweeten the deal [for T3] by charging these large corporate customers a rate on the order of five times the normal T1 rate, but the customer is getting over 30 times the communications capability," says Philip Arst, president of Communications Strategies Inc. in Cupertino, Calif. There is also a market for the 6.144-Mbit/s T2 service, which "is four times faster than the T1 link and better suited for the high volume of data being transferred," says Richard LeCour of NTX Communications Corp. in Sunnyvale, Calif.

These markets are being stimulated by a welter of new products, notably multiplexing gear, such as the Integrated Network Digital Exchange from Network Equipment Technologies Inc. of Redwood City, Calif. "The user with the right multiplexing equipment can get 24 voice-grade lines from one T1 circuit," says analyst Michael De Santis of the brokerage house Alex. Brown & Sons in Baltimore. Another gambit is voice-compression techniques, whereby a single T1 line "can carry up to 90 voice channels," he says.

All of this bandwidth consumption is a foretaste of the day when every business and household will have broadband ISDN, which will run at least 150 Mbits/s, compared with the 64-Kbit/s of narrowband ISDN. B-ISDN will give business users access to teleconferencing, large data bases, computer-aided-design and other computer files on demand, and so on. The lure for home users will be video on demand—the ability to request a video product from a library of materials—and other home services, such as interactive videotex and home-security systems.

A major stumbling block is the expense of rewiring subscribers with fiber-optic cable. John Holt, engineering manager for fiber-optics systems at Pacific Bell in San Francisco, reckons that the cost must be cut to no more than $3,000 to $4,000 per customer, compared with an estimated $16,000 today. *–Jonah McLeod*



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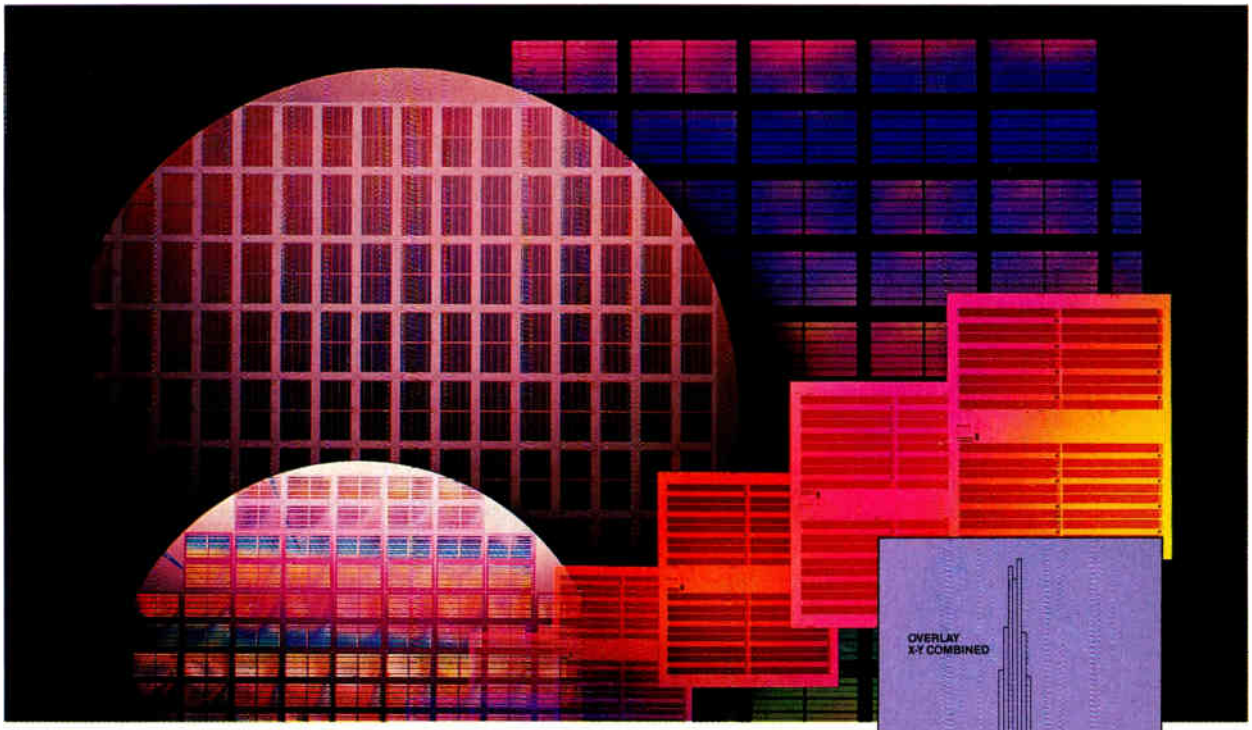

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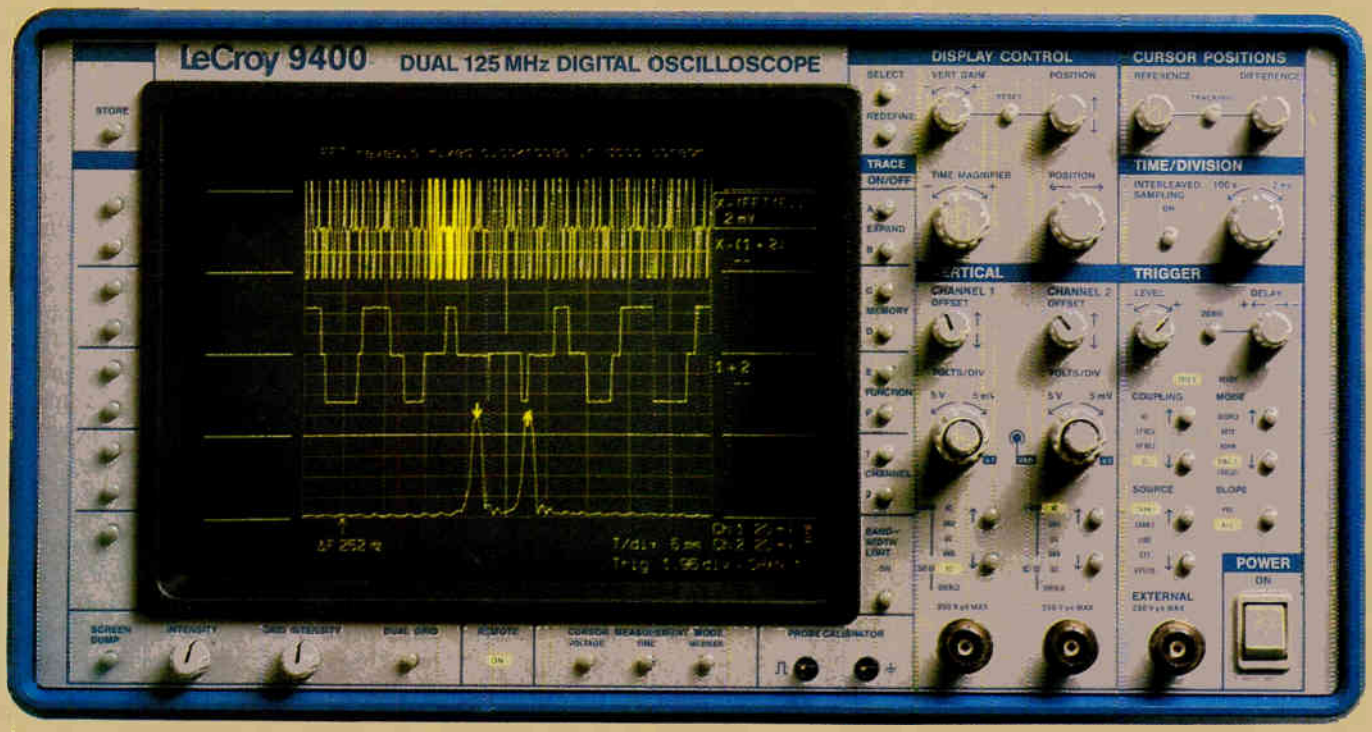

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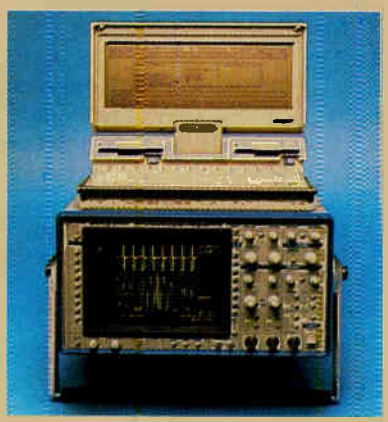

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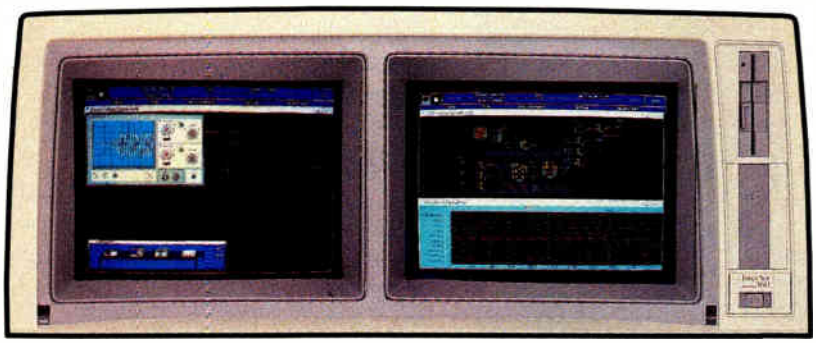
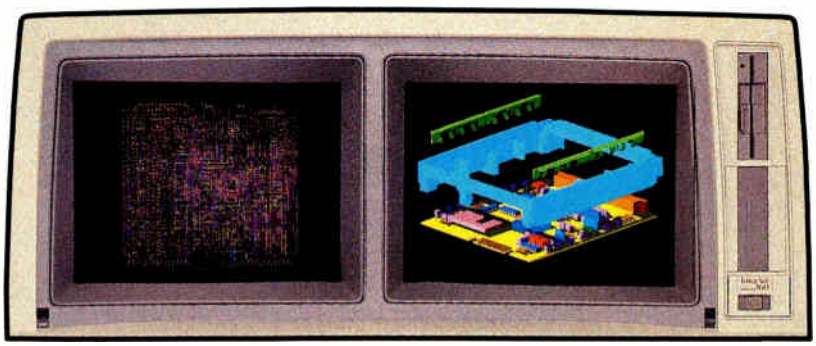


1... Schematic Design with Analog Analysis 2... Schematic Design with Digital Analysis



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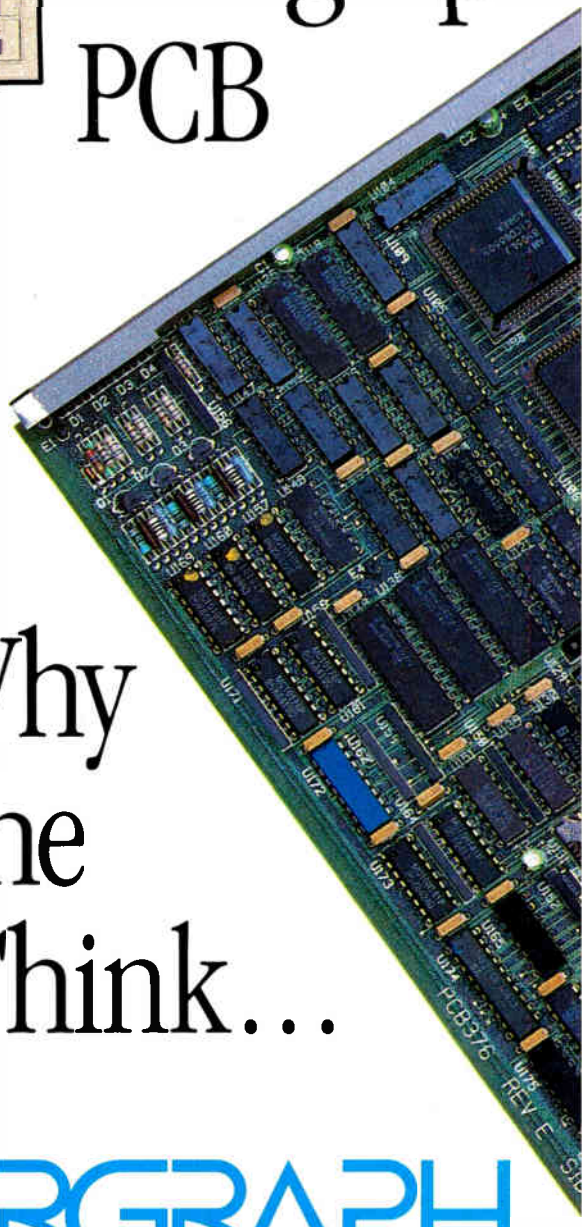

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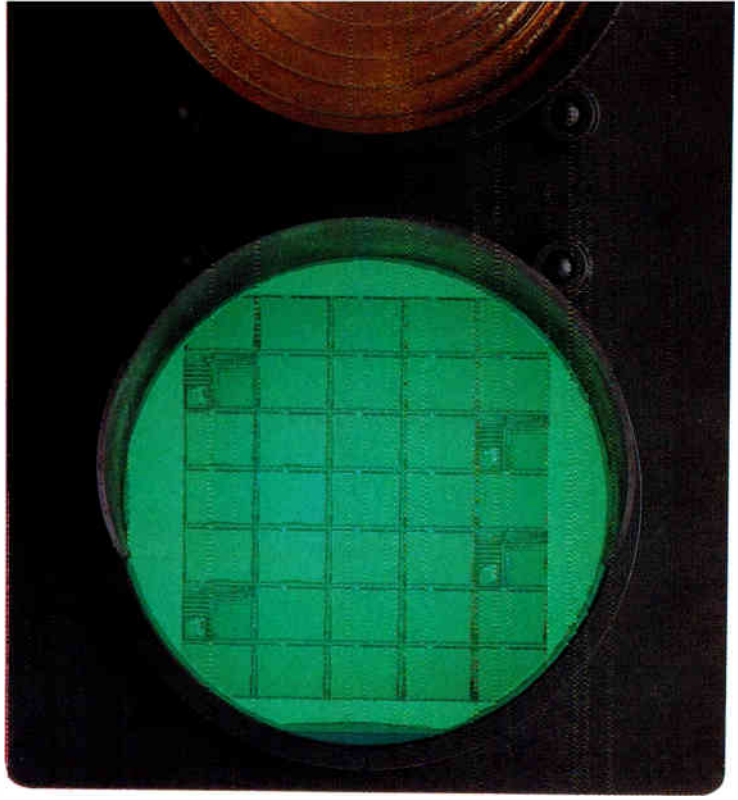

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PACKAGING

TRYING TO KEEP UP WITH FAST-MOVING CHIPS

Coming Soon

- Multichip packages promise 5-to-1 space savings while delivering higher performance
- Teflon-based boards, immune to noise and cross talk, will handle superchip speeds

The chip makers' race toward million-gate densities, 500 input/output pins, and 100-MHz performance is driving the packaging industry to new performance heights. The drive to pack more parts and greater performance onto a chip makes it harder than ever for packagers to solve the interrelated problems of size, reliability, and cost. These problems are being addressed with three major packaging thrusts.

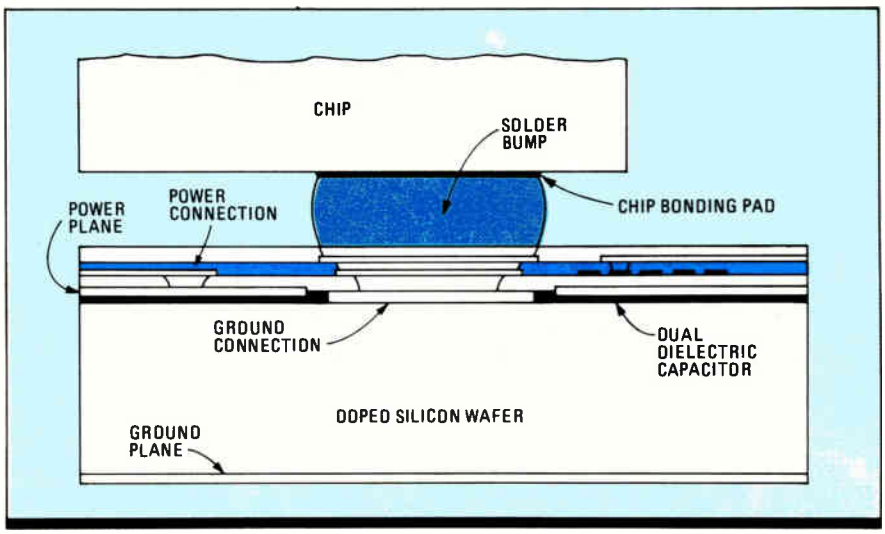
Multichip packages are easing the board-space quandary that sometimes results in packaging taking up to 10 times the space of the die itself. At the same time, such packages boost performance and simplify board design. Meanwhile, new printed-circuit-board materials are solving the cross-talk and noise problems that are poised to overwhelm conventional materials. Finally, the emergence of molded-plastic pin-grid arrays is cutting cost-per-pin in half compared with the price of their ceramic counterparts.

At least six major projects are under way using multichip packages that bond several dice to a silicon substrate, connect them with lithographic techniques, and enclose everything in a single package that might be as small as 3 in. square. Multichip packages squeeze dazzling functionality into a smaller space by eliminating the packaging walls between chips. Package-size reductions will approach 5 : 1 and weight reductions 4 : 1, industry watchers say. The technology holds significant promise in other areas as well. Since lithographic techniques mean that five 1-mil-wide interconnects can be squeezed into a space now allotted to the narrowest pc-board trace, the number of board layers can be reduced. That, in turn, will cut design time in half. And because fewer solder joints will be subject to thermal stress, reliability will jump by a factor of five.

But not before some problems are overcome. While failures related to thermal stress will be greatly reduced, multichip packages have a built-in reliability problem of their own. Statistically, packaging 50 devices with 99% reliability each can result in package reliability as low as 50%. The solution is using tape-automated bonding to test the dice before inclusion in the package, says Robert Wright, manager of Interconnection Technology for Rockwell International Corp. at Cedar Rapids, Iowa. In TAB, bare dice are bonded on tape with leads for testing. Once they pass, all but a nub of the lead is sheared off—just enough is left to bond the die to the silicon substrate.

A prototype being developed at Rensselaer Polytechnic Institute in Troy, N.Y., is squeezing 11 LSI chips into a shirt-pocket-size package to make a minisupercomputer capable of running at 125 million instructions/s, says John McDonald, a professor in the Electrical, Computer, and Systems Department. The 3.4-by-3.4-cm package is populated with dice fabricated by Tektronix Inc., Beaverton, Ore., in its advanced 1-μm polysilicon-emitter process. The prototypes are expected to be ready in mid-1988, but commercialization is "not a technology question," says McDonald, "but a matter of dollars and clean rooms—making the technology economical."

Already beyond the prototype stage is AT&T Bell Laboratories' three-chip package implementing Western Electric's WE32100 32-bit microprocessor and its companion memory-management unit and math accelerator [*Electronics*, May 28, 1987, p. 47]. The 1.3-by-3-in. package will enter the market in early 1988. By shortening interconnections, the package eliminates



3 IN 1. Bell Labs integrates three chips—a microprocessor, math accelerator, and memory management unit—into a single package by bonding each circuit directly to a silicon substrate.

ing the alternatives, and they are far from unanimous in making a final choice, industry analysts say. A favorite candidate of many observers is direct-write electron-beam lithography, which entered the limelight via the Department of Defense's Very High Speed Integrated Circuit program.

But early performance troubles with Perkin-Elmer Corp.'s Aeble 150, built for VHSIC Phase 2 production, has contributed to doubts about e-beam's commercial potential. So far, direct-write e-beam has been used mostly for small-run gallium arsenide designs, where the precision advantage of the technology suits it for gates with dimensions down to 0.25 μm. E-beam's main debit is low throughput, with resulting yield and cost problems. Despite the claims that Aeble 150-type e-beams can produce up to 30 four-in. wafers an hour—a figure competitive with optical steppers—in practice the rates have been less than 10 wafers, most sources agree.

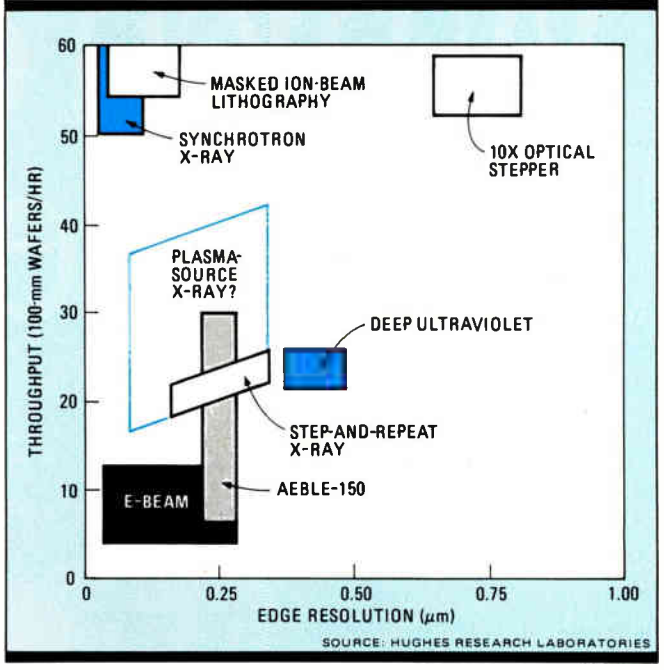
This is not a handicap with application-specific ICs, however, which generally are produced in low volumes and with fast turnaround times. Proponents are trumpeting e-beams as the next equipment of choice for ASICs, which could be the majority semiconductor type by the 1990s. But skepticism still abounds. Richard C. Henderson, manager of the Silicon IC Dept. at GMHE/Hughes Aircraft Co.'s Research Laboratories, is doubtful about upping yields and lowering costs. The problem could be solved by teaming an e-beam equipment supplier with a heavyweight device manufacturer, "but no U. S. company is making the effort," he says. His Malibu, Calif., lab, a major center of research into semiconductor processing, developed the e-beam design that became the Aeble 150.

E-BEAMS FOR ASICS?

Surprisingly, this downbeat assessment is echoed by a major e-beam supplier, Japan's JEOL, whose $3.5 million model 683 is a principal competitor of the similarly priced Aeble 150. "We see no e-beam sales to ASIC production," says Michael Hassel Shearer, product manager for e-beam and ion-beam lithography at JEOL's U. S. operation in Peabody, Mass. He predicts that the technology will stay largely confined to specialty production, primarily GaAs, unless a clear economic advantage emerges. This has not occurred even in Japan, where JEOL alone has installed some 25 e-beam units. Industry consultant Jerry D. Hutcheson concurs, and can spot "no dramatic new push ocurring in e-beam." President of VLSI Research Inc. in San Jose, Calif., he downplays throughput as the main barrier. "The real killer is price," he says. "Only the military or the largest ASIC manufacturer can afford e-beam."

Market consultant Dataquest Inc., also in San Jose, takes a similarly restrained view, but analyst Joseph Grenier thinks the throughput issue "might be a crossable barrier if a very high-throughput machine is developed." Beyond that is another hurdle, he says, "which is psychological—the reluctance to change." Grenier and others believe that IBM Corp.—which has been operating some 40 e-beam machines for years, primarily for fast-turnaround prototyping—could provide impetus to the technology. "They have vast direct-write experience and incredible capacity in the area, but have not chosen to share it," says Grenier.

HOW SUBMICRON LITHOGRAPHY SYSTEMS STACK UP



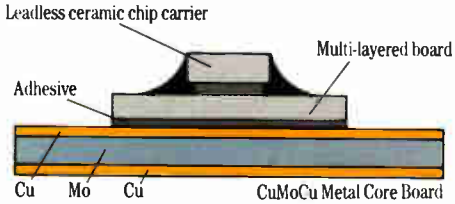
The only e-beam/ASIC program of consequence has surfaced at European Silicon Structures, which is using an Aeble 150, but few details have been revealed. Perkin-Elmer's Charles Biechler, vice president and general manager of the Electron Beam Technical Division in Hayward, Calif., says the European concern finds an economic advantage in manufacturing 10-level CMOS devices. "We believe strongly that when this success becomes more visible to competitors, they are going to have no choice but to emulate it," he says.

If not e-beam, then what other semiconductor line-making technologies have solid possibilities to take over at 0.5 μm? X-ray lithography's chances, strong a few years ago, have declined sharply, particularly at leading U. S. research-and-design organizations, although strong efforts continue in Europe and Japan. TI's Chatterjee believes that at 0.5-μm and maybe down to 0.4-μm, "the use of excimer-laser lithography is going to be adequate." At Hughes Research Laboratories, John L. Bartelt says masked ion-beam lithography, invented at Hughes in 1974, offers better submicron resolution and higher throughput capability. He cites recent innovations in mask technology, ion optics, mask/wafer alignment, and step-and-repeat stages, which have resulted in a prototype system that demonstrates throughput of up to 60 four-in. wafers per hour with 0.1-μm alignment and 0.1-μm resolution. "Masked ion-beam lithography is suitable for any of the process technologies, from 0.5 μm down to 0.25 μm," says Bartelt, manager of the Ion Physics Department. Hughes does not build semiconductor equipment for the commercial marketplace, but is considering a licensing agreement. *–Larry Waller*

Which core mate keep their cool in

High density surface mounting of leadless ceramic chip carriers has created new thermal and mechanical problems for those working on high reliability electronic projects.

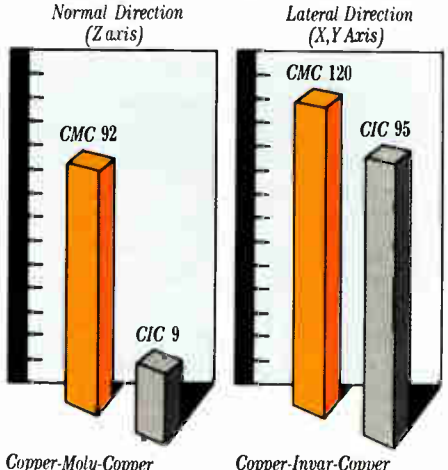
More and more companies are addressing these problems by incorporating metal cores as thermal mounting platforms in their printed circuit board assemblies. The choice of metal laminate comes down to two: Copper-Clad Molybdenum or Copper-Clad Invar. Both do an equally good job of solving the problem of the coefficient of thermal expansion (CTE) mismatch between chip carrier and substrate. But, that's where the similarity ends.



Dissipating the heat.

Higher packaging densities create higher watt densities. Dissipating this heat can be as critical as matching the CTE of an assembly. The thermal conductivity of Copper-Clad Molybdenum is comparable to aluminum and much higher than Copper-Clad Invar, making it a superior heat sink. Compared to Copper-Clad Invar, Copper-Clad Molybdenum is 25% more conductive in the x and y axis, and 900% more conductive in the z axis!

Comparison of Thermal Conductivity (BTU/hr-ft F°)



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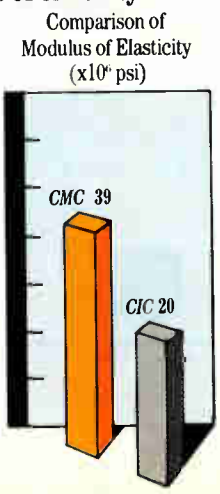

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AIR FORCE TO TRY AMORPHOUS-SILICON, ACTIVE-MATRIX LCD

The Air Force wants to see if liquid-crystal displays with an active matrix of amorphous silicon can outperform electroluminescent displays in the rugged, portable flight-line computers that will be part of its Integrated Maintenance Information System program. The search has led to Ovonic Imaging Systems Inc., which will develop two 6-by-8-in. flat-panel displays for the Air Force Human Resources Laboratory at Wright-Patterson Air Force Base in Ohio. If the Troy, Mich., company meets its goals, the 640-by-480-pixel active-matrix displays will draw only 1 W to 1.5 W of power—roughly 3% of what a comparable EL display requires—while maintaining about the same resolution, 80 pixels/in. Further, the Ovonic Imaging displays will feature a 90° viewing angle—compared to about 60° degrees for EL—with a 20-to-1 contrast ratio that is comparable to EL. IMIS is being considered for use on the next-generation Advanced Tactical Fighter. □

EIA: GROWTH IN DEFENSE-ELECTRONICS SPENDING IS LEVELING OFF

The electronic content of U. S. defense work, including procurement and research and development, is beginning to level off after six years of fast and steady growth, according to the Electronics Industries Association. The Defense Department now spends some $53 billion, or about 40% of its annual budget, in these categories. In its annual 10-year forecast for the defense-electronics market, the EIA predicts that this proportion will hold steady at or near the 40% level through 1997. Overall, EIA forecasters look for defense spending to decline slightly until it bottoms out in 1992. They expect, however, that spending will then begin to rise at about 1% a year. R&D funding, they say, will remain at its present peak through 1988. As for the Strategic Defense Initiative, the EIA says spending will stay in the $3.5 billion to $4 billion per year range through 1997. □

CUSTOMS ADDS MORE RADAR BALLOONS TO SPOT DRUG SMUGGLERS

The U. S. Customs Service will add half a dozen tethered radar balloons to the one it is now operating to spot low-flying planes and surface vessels smuggling drugs into the U. S. One of the new balloons will flesh out the coverage in the Caribbean, where a single aerostat is now stationed over Grand Bahama Island, while the others will be deployed over the next two years along the southern border of the U. S. The first will go up in early November from Fort Huachuca, Ariz. The new balloons, supplied by Westinghouse Electric Corp. Defense and Electronics Systems Co. of Baltimore, cost $15 million each and carry a modified Westinghouse AN/TPS-63 radar at altitudes to 15,000 ft. Data from the radar is transmitted to Customs Service ground stations. □

FROM THOMSON, A DIGITAL DISPLAY MAP FOR FRENCH TACTICAL AIRCRAFT

Thomson-CSF is developing a high-speed digital map system for the Tactical Combat Aircraft, the French equivalent to the U. S. Advanced Tactical Fighter. The system will store 150,000 square miles of mapped terrain on 5¼-in. optical disks, offers 512-by-512-pixel full-color resolution, is powered by a custom microprocessor, and has a 60-Hz noninterlaced refresh rate, says Patrick Berniolles, an engineering manager with Thomson's Aerospace Group in Issy-Les-Moulineaux, France. Called Dracar, the system is optimized for ground-collision avoidance, and key to that will be the next step in Thomson's development work: completion of a display mode that, by providing a digitized perspective view of the terrain, will help pilots keep their craft low to the ground and below enemy radar, Berniolles says. □

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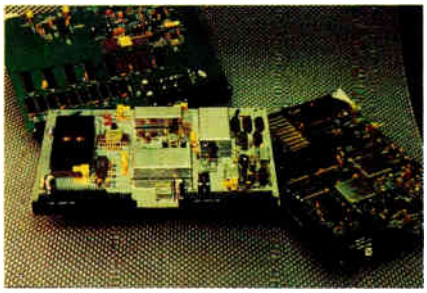

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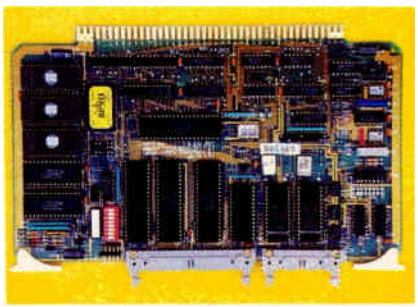

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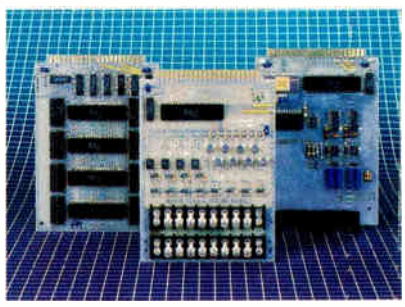

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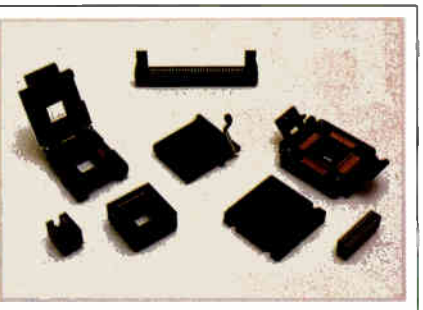

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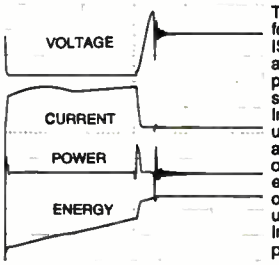

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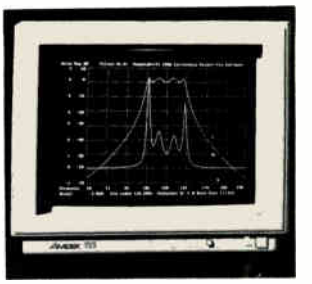

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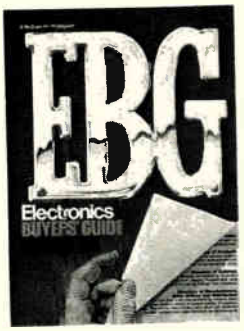

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