go/semiconductor

Ideas and Information for Test Engineers and Managers

HEWLETT PACKARD
Expanding Possibilities

A view fr om the top

Lew Platt: Challenges of a Hewlett-Packard CEO

'We are very committed to the Test & Measurement business here at Hewlett-Packard.'



In an exclusive interview for go/semiconductor , Lew Platt, CEO of Hewlett-Packard, discusses his role as a CEO and Hewlett-Packard's role in the semiconductor industry.

Q: There are rumors circulating that Hewlett-Packard may be putting the Test & Measurement Organization (TMO) on the auction block. Are the rumors true?

Platt: There have been rumors recently about HP selling off TMO or selling off portions of TMO. I want to make it clear that we have no active plans to sell TMO.

All this concern came about because of a project we've got going that is looking over HP's business portfolio, our practices and our culture. I think a segment of the media became a bit excited and went out on a limb, simply speculating about what we could do. But there's just no truth to rumors that we're actively discussing selling TMO.

We are very committed to the Test & Measurement business. Over time, anything is possible because we regularly evaluate our businesses to ensure the best value for stockholders.

Q: What about the Semiconductor Test Group?

Platt: The semiconductor-test business has been a really integral part of the TMO portfolio. It has given us some excellent growth in years past. We have staked out a first-rate position, and we certainly see it as strategic and important to our whole TMO group.

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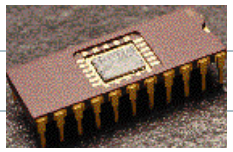
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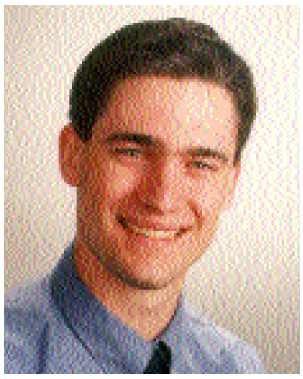
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foreword

A European view: Optimism about semiconductors

By Jan Manger, managing editor, winter issue

As we look back at what turned out to be a rather difficult year for the entire semiconductor industry worldwide, we here in Europe see a somewhat different picture regarding the divergent market segments and economies. And we are optimistic about semiconductor growth in Europe.

The European market was largely flat during this recent worldwide downturn. In fact, according to *Dataquest* statistics, compared to other regions, only Europe will retain a positive growth number in 1998, having had a 1.4 percent increase in revenues over the previous year. A little growth, but not any dramatic increase.

That is because the European companies here serve some of the same international customers as the rest of the semiconductor industry and they were hit by the economic problems just as well. Adding to the difficult situation was a large number of fab closures in Europe, by regional as well as foreign companies, including Siemens, Fujitsu, Seagate and Motorola, all of which either closed or consolidated their fabs.

But the industry is still blossoming. A total of 56 different manufacturers currently produce semiconductors in Europe, in more than 150 separate facilities. Another three companies have new fabs under construction, and at least 10 more major production centers are expected. In a recent article in *Electronic News*, Malcolm Penn, the chairman and CEO of Future Horizons, a UK-based research company, forecast that the wafer fab capacity in Europe will reach by the year 2001 more than two-and-a-half times its capacity in 1989. "Europe is now the most competitive (semiconductor) manufacturing area in the world," Penn said. European companies are well positioned where they serve the domestic market or where they are non-reliant on memory products. A case in point was STM: sales of the memory group remained flat, but more than 60 percent of STM's revenues come from "differentiated" products. Thus, a majority of its gains come from custom and semi-custom chips.

One of the highlights here in Europe is the market for Smartcard ICs. Three of the top five companies in this market are based in Europe—Siemens (# 1, with 43 percent of the market), STM (#2 with 33 percent), and Philips (#4 with 6 percent). Together they have about 80 percent of the worldwide sales.

At the same time that the semiconductor industry worldwide faces this difficult economic situation, the technology advances rapidly, changing the way of producing and testing semiconductors.

In the last issue of *go/semiconductor*, we focused on the system-on-a-chip (SOC) revolution. With SOC technology, the entire electronics industry appears to be on the verge of a radical transformation. SOC will enable large growth potential but at the same time it is putting tough requirements on wafer fabs and test.

A change that is not driven by technology but by the changing market is the move of the trade show, SEMICON/Europa. The show, which will be held April 13 to 15, will not only change its location from Geneva to Munich, but also its character regarding semiconductor test. Hewlett-Packard will take the opportunity to relocate to the new test pavilion and exhibit the broad portfolio of Semiconductor Test solutions. We are looking forward to welcoming you in the new Munich exhibition grounds. ■

DID YOU KNOW ?

Interesting facts about some animals

- A cat has 32 muscles in each ear.
- An ostrich's eye is bigger than its brain.
- Tigers have striped skin, not just striped fur.
- A goldfish has a memory span of three seconds.



The Asian economy

A millennium for ecast:

The Asian economy will impr ove!

The following is based on interviews with several global economists, who discussed the state of the current Asian economy, as well as their assessment of the future of that collective economy.

The Asian economy will be on the upswing, particularly for the semiconductor industry, and the Year 2000 should start out the millennium in an upbeat mode in East Asia. Even better, within three years, the economy in nearly all of Asia should be expanding.

This according to leading economists, who were interviewed for *go/semiconductor* on the current economic climate in Asia, and their own economic predictions for the area.

"I think the Asian economic recovery is, with the exception of Indonesia, which has serious political problems, about on track," said Lawrence Lau of Stanford University, who holds the Kwoh-Ting Li chair, Professor of Economic Development. "By the middle of 1999, almost exactly two years from the first trouble in Thailand, I think most of the East Asian economies will resume growing.

"By mid-1999, with the exception of Indonesia, most East Asian economies should be on the recovery track, and growth will resume," echoed Richard Carlson, CEO for Spectrum Economics, a Palo Alto, CA-based economic consulting firm specializing in the technical sector. Stanford Professor of Economics Michael Boskin, was a bit more hesitant. "I am bullish about Asia long-term, meaning the next 10 years. The next three years I see some difficulties," he said. Boskin served as chairman of the U.S. Congressional Advisory Commission on the Consumer Price Index.

But even with the recent slowdown, optimism for the semiconductor industry is apparent. "The world will keep on needing semiconductor equipment for as far as we can see," Carlson said.

See-saw attitudes

The markets have been optimistic lately. In the past three months, U.S. and Asian stocks have regained some of their luster, and for the year, markets in South Korea and Thailand have gained more than 25 percent.

But there are doubts as well. "The world is teetering on the brink of generalized recession. The economic situation in 1998 for the (Pacific) region has deteriorated badly," the Pacific Economic Cooperation Council warned in mid-November.

Japan, Asia's largest economy, is facing a credit crunch, a collapse in consumer confidence, and deflationary fears. And from Japan to Indonesia, unemployment is rising as small businesses find themselves unable to find the cash they need.

Why the recovery is coming

Several factors contribute to the Asian recovery, including relatively calm and stable foreign currency markets (helped considerably by the reduced influence of hedge funds), the resulting decline of the rate of interest across Asia, and the reductions in the interest rates in the United States. "As interest rates decline, credit conditions ease, and new investment projects are once again possible, especially in light of the newly realigned exchange rates," said Lau.

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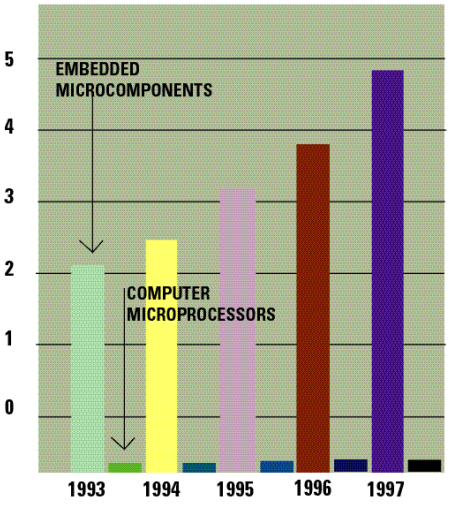
'By mid-1999, with the exception of Indonesia, most East Asian economies should be on the recovery track, and growth will resume.'

—Richard Carlson

Challenges of a CEO

DID YOU ? KNOW

THE GROWTH OF MICROCOMPONENTS



BILLIONS OF UNITS SHIPPED WORLDWIDE

The production of computer microcomponents, which are designed to perform a fixed set of functions, are far more numerous than the production of computer microprocessors.

Source: Dataquest

Continued from page 1

The semiconductor-test business has provided excellent growth and very good profitability. We may be having a bit of a tough time right now, as the whole industry goes through a down period, but there's no question that it will be a good business again, just as it has been in the past. A portion of HP's businesses always are going through cycles, but we don't jump to sell divisions off just because they happen to be in a down cycle.

Q: Which new products do you especially like?

Platt: There are clear outright winners—Rambus, for instance. We really have a great product there. We are on the leading edge, already booking business with the leading suppliers of Rambus, so it looks like a place where we are going to have a huge victory.

Q: What accounts for HP's success in developing some of today's exciting new technologies within the semiconductor-test industry? There is a lot of interaction between the Integrated Circuits Business Unit, and the semiconductor-test side.

Platt: I think there are some natural synergies between the semiconductor-test equipment business and HP. First, it's a very difficult technical job to test these semiconductors, and anything that's hard technically naturally plays to HP's strengths because this is what we do best.

Second, we are huge users of semiconductors ourselves. We are one of the largest users in the world, and we also manufacture and design semiconductors. So, we know a lot about this business as users, designers and manufacturers of these products. I think the next-bench syndrome is very much at work here at HP and allows us to design and pull together products and system-testing capabilities that are unique in the industry.

In turn, we're able to help our partners, whom we use for manufacturing, to be more effective in helping us. Everything is time-based competition these days. Those who get to market first, win big. Those who get to market late, don't win at all.

Q: What is your biggest challenge, as CEO and president of HP?

Platt: That's a difficult question. I think one of the biggest ongoing challenges is finding a way to keep the organization on edge. A number of years ago I began talking about complacency. It might have been the wrong word, but I was using it to describe an organization that somehow became very satisfied with what it was. It was an organization that had lost its edge, lost its sense of urgency, lost some of its competitiveness. I think one of the true roles of all CEOs is to make sure that the organization is always on edge, always doing the very best it can, whether things are really good or really bad.

It is easier during the bad times to get the organization to feel that we need to be redoubling our efforts to get to market early, to really come out with creative new products, than during good times, when it is very difficult to do this because want to bask in the success that we are having.

Q: What is the most rewarding and/or exciting part of your job?

Platt: That's easy. The most rewarding and exciting part of this job is actually seeing HP succeed. It is fascinating. When HP is not doing well, there is nothing that anyone can do to make me happy. And there is almost nothing anyone can do to

Continued from page 4

make me really unhappy when HP is doing well.

I think any time you have an opportunity to lead a great company like HP with 125,000 really dedicated employees, you just get your kicks out of seeing the organization working well, seeing it winning in the marketplace, and delivering really good value to shareholders. That's what it s all about. It's like being a football coach. There is no good day when your team loses, and there is no really bad day when your team wins.

Q: Among the Fortune 500 companies, is there a particular CEO that you admire, and, if so, why?

Platt: I admire a lot of Fortune 500 CEOs and, fortunately, one of the nice parts of the job is that I have gotten to know a number of them quite well. Certainly, Jack Welch of General Electric would have to come up high on the list. I think Jack has taken a company which, in many ways, could be a tired, sleepy organization, but he has really managed to energize it. He runs a company that is involved in widely different businesses and does it all very successfully. There is a spirit that runs around the company. It has year in and year out turned in just great numbers and lots and lots of success. You have to admire that. He has not done it for a few years; he's done it for 13 or 14 years.

Jack has run a very decentralized company. He lets his people who run the businesses really have a lot of freedom, but he holds them accountable. He is a tough manager and really does hold people accountable. So he has this wonderful balance of freedom, but also accountability. Any Fortune 500 CEO who can see another CEO who has managed things as widely divergent as GE—a huge financing business, engineered plastics, jet engines, light bulbs—can't help but be very impressed.

Q: If I asked the managers who work for you for a description of your management style, what would they say?

Platt: I think they would say that I understand what it means to run a decentralized business, that I really do give them quite a few freedoms in terms of doing different things, but that I also demand that they produce results and take actions when those results are not being produced. I have tried to strike this balance between allowing a lot of freedom, a lot of leeway to run your business the way you think it should be run, but you also better produce the results. I hope people who report to me would say I'm demanding, tough, but very fair.

Q: How has our global economy affected you in terms of how you operate and go about making decisions?

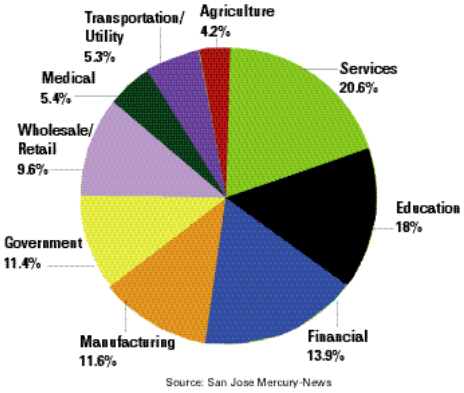
Platt: Participating in a global economy the way HP does has certainly made me much more patient about the cyclical nature of the business. Being global has huge advantages, but you do expose yourself to global macro-economics, and we are seeing the effect of that right now.

What that speaks to is the need to manage over a total business cycle. Any time one part of a world is in a down cycle, you can usually find some other part of the world that is in a pretty strong up cycle. This actually helps to dampen some of the effect that you would be facing if you operated in only a single part of the world.

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DID YOU KNOW ?

PC sales by industry



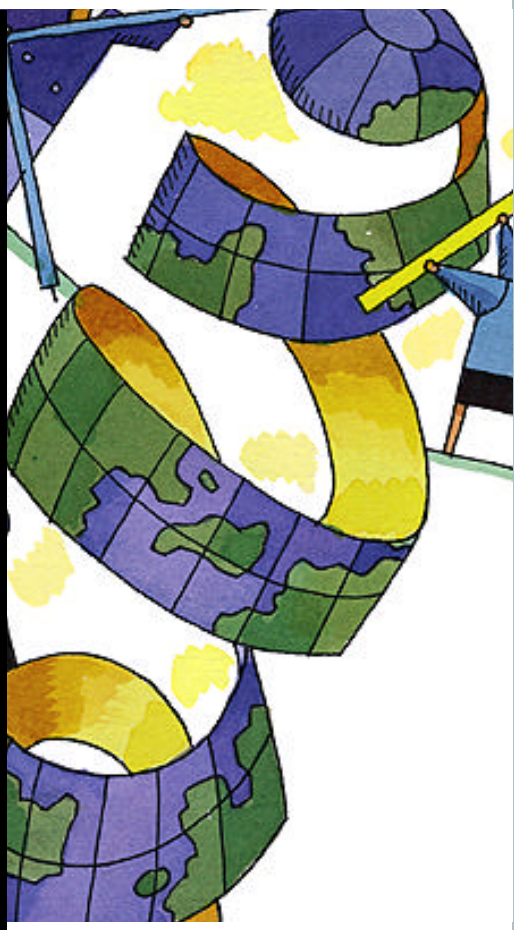
Source: San Jose Mercury-News

Service and education industries are the leading purchasers of PCs, 1998 figures show.

Asian economy

Global economists are upbeat about Asia

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Taiwan and Singapore never were in serious trouble, Lau said. In fact, Taiwan had a growth rate above 5 percent. And next year, while the growth of exports from Taiwan will be slow, the domestic infrastructure investment should pick up in Taiwan. So the rate of growth should be in the 4 to 5 percent range. "What we should take into account is the fact that almost all of the East Asian economies will be coming out of their recessions," he said.

The bubbles

"The stock market bubbles did not happen as dramatically in South Korea," Carlson said, and recovery is now under way. Despite the overbuilding of factories, the Koreans are making good salable products the world wants, and it has vast conglomerates it is developing in consumer electronics, semiconductor shops—and footwear.

In Indonesia there is no sign of recovery, while in Russia the progress is very slow. Hong Kong is working out its stock market and property bubbles. And China's economic pace may have slowed down, but it still has the best economic growth rate in the world (7 percent). While there is very little production of semiconductors, the country is capital intensive.

U.S. and European semiconductor corporations may consider redirecting their sales efforts from eastern Asia to other global markets, at least for the next couple of years, Carlson said. "Europe itself has not yet had a full utilization of semiconductor equipment. It is way ahead (of the U.S.) in the use of cellular phones, but behind in computer production. The system-on-a-chip and embedded systems markets are exploding."

However, the East Asian economic crisis has also swept away many potential competitors, Lau noted. "Only the strongest firms will survive. These are firms that have strong and dominant core competencies in specific niches of the semiconductor market, e.g., Intel, Taiwan Semiconductor Manufacturing Corp., etc.," Lau said.

Still some worries

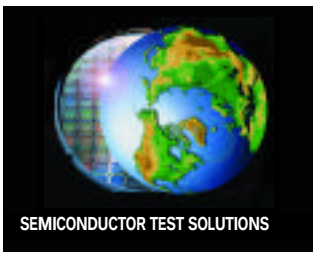
The biggest worry about the Asian economy for Lau is the excessive tightness in both the monetary and fiscal policies. "Now is the right time for government-sponsored domestic stimuli in these economies, because of excess capacity, weak domestic demand, and little inflationary pressure."

Optimism ahead

The economists agreed the east Asian crisis will soon be over, although estimates on when that may happen varied slightly. "I think the semiconductor industry will come out of this downturn reasonably quickly, as soon as the demand for the underlying products, such as personal computers, revives, which maybe five quarters from now. The recovery of the semiconductor manufacturing equipment industry will probably take longer, perhaps seven to nine quarters from now," Lau concluded.

"From the sales perspective," Carlson added, "most of Asia will grow, but not at the same rate. The markets will not expand in the next three to five years as fast as they have been. But this is a chance to gain market share because some Asian banks will not be financing as many corporations as they have been."

Carlson noted that there also will be openings now for a new generation of Asian business people—well-educated people. "The older executives are being forced out, because the economy failed. The area is now more open for foreign investment, and for the younger generation." ■



For more information, please contact your HP sales engineer. Or visit our Website at:

http://www.hp.com/go/semiconductor

news and views

European semiconductor market drives the expansion of SEMICON

SEMICON/ Europa is moving from Geneva to Munich, in response to the recent growth in Europe's semiconductor test market, and it is expanding its focus to include all manufacturing products (front-through back-end test) as well as a full test conference, including workshops and panels. Semicon Europa is slated to run in Munich from April 13-15, 1999.

"Europe held steady in 1998," says Ed White, director of programs for Semiconductor Equipment and Materials International (SEMI), a global trade association that hosts SEMICON/Europa. "The EC (European Community) has structured itself to encourage companies to build fabs within Europe and to bring back-end production back into Europe from Asia. Plus, what may be the world's first 300mm wafer fab is slated to be in volume production in Dresden by 2000. The upshot is that capital equipment spending is holding up well in the EC."

White added that he anticipates the EC growing slowly and steadily to 20 percent of the world semiconductor market. "Manufacturing test conference activity at SEMICON/ Europa will now be driven by a test committee composed solely of European test floor managers and ATE company managers," White said.

Rambus chooses HP for Comdex partner

Rambus Inc. selected HP to take part in the Rambus booth at the Comdex trade show which was held Nov. 16 to 20, 1998 in Las Vegas, Nevada. HP's role in the Rambus booth was to demonstrate testing RAMBUS technology. HP is uniquely qualified to demonstrate this since more than $1 million of RAMBUS devices have been tested on HP systems.

Exhibitors at SEMICON/Europa are scheduled

The latest in parametric test, process control, and VLSI test will be showcased at the HP booth at SEMICON/Europa. The companies exhibiting in the test pavilion, alongside HP, include: Cerprobe, Electroglas, Feinmetall, Firfax, HP, Intest, Microhandling, and Wentworth, and other HP third parties.

The exhibits by HP will include VLSI Test, Microcontroller Test, Parametric Test, Process Control, Wafer Level and Reliability Test, plus others.

HP celebrates 'State of the Art' as a work of ar t

With the announcement of Hewlett-Packard's entry in to the high-speed memory test market, HP unveiled an impressionist-style painting of the HP 95000 HSM series memory test system at the National Museum of Women in the Arts in Washington, D.C.

The painting by Gaines Clore was displayed at the museum during HP's ITC customer gala, where more than 150 guests were invited to enjoy the museum's galleries.





ITC attendance down, HP booth interest up

Attendance at an ITC dinner sponsored by HP was very high, although the ITC show attendance was down 29 percent this year. HP's booth traffic remained strong throughout the exhibition.

The HP booth featured test solutions for on-wafer test of RFIC devices, cost-effective production testing of microcontroller devices, solutions for Y2K compliance that minimize system down time, financing and leasing products for maximum ROI, HP's Gigabit technology display, and the introduction of the HP 95000 HSM series memory test system, which displayed HP's test cell solution for testing high performance memories in high volume production environments.

All products addressed HP's theme on the need for Speed, Technology, Experience, Price/Performance and keeping one STEP ahead of the competition.

HP products were also featured in the TSK and Delta booths where TSK was demonstrating 4062A DC parametric test cell and Delta was demonstrating the HP MCU system in full production mode.



news and views

Asian countries drive demand for HP systems



The HP 83000 semiconductor test system.

HP sells its 500th HP 83000 VLSI test system—celebrations in Taiwan

Semiconductor contract manufacturers in Taiwan, other Asian countries, drive demand

In conjunction with the 1998 SEMICON/Taiwan trade show, Hewlett-Packard sold its 500th HP 83000 semiconductor test system, and the event was celebrated at the 1998 SEMICON/Taiwan conference held in early November.

The HP 83000 family of VLSI test systems, with true Test Processor-Per-Pin architecture, provides a full range of performance and price options. The family of test systems can test virtually any type of VLSI device, including Systems-on-a-Chip (SOC).

HP shipped its first HP 83000 test systems in 1991 and has grown a worldwide-installed base of 500 systems during the last seven years. Because of this high demand for the systems, HP has become the second largest VLSI test system supplier in the world, according to an April 1998 study conducted by the Prime Research Group.

Semiconductor contract manufacturers alone have purchased more than 100 of the HP 83000 systems. One of the leading users of HP 83000 systems is Taiwan Semiconductor Manufacturing Company (TSMC), the first integrated circuit (IC) foundry company in the world. TSMC has provided contract manufacturing services for virtually all of the leading performance ICs worldwide.



Celebrating the sale of the 500th HP 83000 at SEMICON/Taiwan.

"Design houses, test service companies and contract manufacturers all have played an important role in the widespread global acceptance of HP 83000 systems," said John Scruggs, HP vice president and general manager of the Automated Test Group. "One major reason is that we have a very comprehensive Semiconductor Contract Manufacturing program in place to meet the needs of our fabless customers and their manufacturing partners."

"HP 83000 VLSI test systems and the HP Semiconductor Contract Manufacturing program play an important role in TSMC's business," said Mark Liu, senior director of TSMC's South Site Operation. "Working with HP clearly has helped us leverage more business. HP 83000 Series VLSI test systems offer TSMC the test performance and flexibility we need to guarantee the delivery of high quality ICs to its customers. While providing a high level of test performance, they also help us keep costs to a minimum."

The HP 83000 is used to test a wide range of VLSI components, including multimedia chip sets, microcontrollers, CPU devices, full custom ASICs, FSRAM (Fast Static Random Access Memory), embedded memory and networking devices with analog features. The system's flexibility, along with its proven high reliability, enables increased system utilization and extends system life. ■

Dell gets Direct Rambus RIMMs from Toshiba and Kingston

Toshiba America Electronic Components Inc. said its first Direct Rambus RIMM memory modules have been shipped to Dell Computer. The U.S. subsidiary of Toshiba and memory-module maker Kingston Technology Corp. jointly developed and delivered the Rambus RIMMs to Dell. Shipments to other PC makers are expected in 1999. The modules from Rambus Inc. achieve a maximum bandwidth of 1.6 gigabytes per second—double the rate of PC100 DIMM DRAM modules.

Siemens makes direct RDRAM with 0.20-micron technology

Siemens AG's semiconductor unit claimed to be the first to produce functional 64-Mbit and 72-Mbit Direct Rambus DRAMs. The die size of the memories is 58-mm2, which Siemens' Semiconductors Group said was the industry's smallest 64-Mbit / 72-Mbit Direct RDRAM. The chip is processed in a 0.20-micron technology and housed in a micro ball-grid array package. Mass production is slated to begin in the middle of 1999, according to Siemens.

Samsung develops 144M Rambus DRAM chip

Samsung Electronics Co., the world's largest memory chip maker, said it has developed a high-speed 144-megabit Rambus DRAM chip and a 144-megabyte Rambus DRAM module for the first time.

"Our new Rambus chip functions 15 times faster than normal DRAM chips and six times faster than synchronous DRAM chips," said a Samsung official.

"Our monthly production will reach 100,000 units starting early in the year and increase to 1 million chips per month by the second half of 1999," said the official.

Meanwhile, with the advent of the Rambus DRAM module, global PC makers are expected to replace their existing synchronous DRAM module with Samsung's new module, which employs a 0.23 micron design rule and is capable of handling data equivalent to 128,000 newspaper pages/sec.

"With our new chip and module, we hope to continue to lead the next-generation memory chip market," said the Samsung official. The global market for the 144-megabit Rambus DRAMs is estimated at $2.6 billion next year, with an estimate for 2000 at $13.5 billion. ■

Platt: Challenges of a CEO

Continued from page 5

Q: Some countries' economies are really down. How do you manage through those tough times?

Platt: Let's take Korea, for example. We achieved a billion dollars in business there faster than we had done in any other country in the world. Then we hit a wall when the Korean economy fell off. We think it could well be three years before we get back to our previous level of business in Korea.

Mexico is a good example, too. When the Mexican economy was having difficulties in the mid-1990s, we chose a path that was very different from what a lot of other companies did there. We kept our work force, we maintained our relationships with our partners. We did not panic. We were known as dependable and steady. It took us two years to recover. The actions that we took—or did not take—when there was a downturn in Mexico have left us in just a phenomenal position now that the Mexican economy is recovering. Due to our direct presence in many countries, we can quickly grow our business as the economy of a country grows.

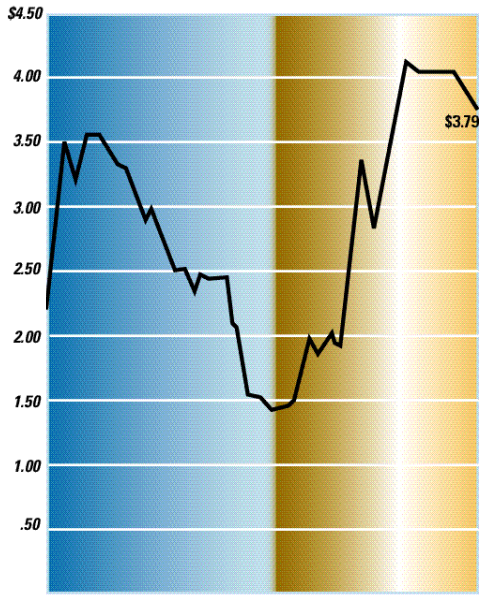
Q: What do you feel are the real strengths of the HP organization?

Platt: The strengths of our organization are the same today as they were when I joined it, and it's basically our people all around the world. HP is fortunate. We have been and still are able to hire the best people. They stay with us. We have very low turnover compared to virtually every other company in our industry. We are made up of great people who are strongly committed to the success of HP and its customers. At the end of the day, it comes down to knowing that the team with the best resources usually wins, and that's why HP has won decade after decade. ■

DID YOU KNOW ?

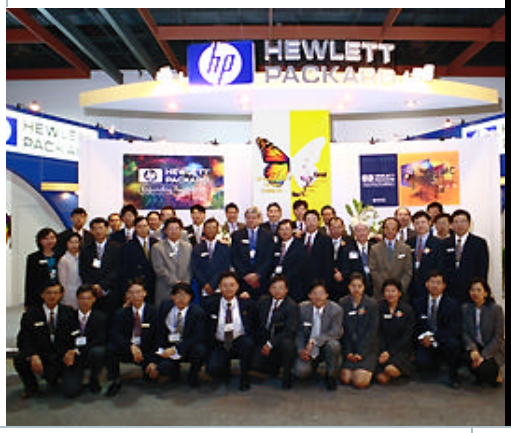
DRAM

The worldwide price of 16-megabit DRAM ranged from U.S. $1.40 to $4.14 during 1998.



Source: San Jose Mercury News

Picture below is the HP team at the HP exhibit at SEMICON/Taiwan last autumn.



customer partnership

HP Total Test Solution plus local support adds up to winning partnership for TSMC

Customer: Taiwan Semiconductor Manufacturing Company (TSMC)

HP Systems: HP 4062UX and HP 4071A/SPECS parametric test systems

Challenge: Find a semiconductor test partner to provide comprehensive local support and a total test solution, including automating wafer acceptance testing.

Solution: Partner with Hewlett-Packard; use HP semiconductor parametric test systems.

Results:
- Local support gets TSMC up and running quickly
- HP Test Systems improve throughput, reduce costs
- High uptime translates to lower manufacturing costs
- HP's total solution approach provides competitive advantage

The company

Founded in 1987, Taiwan Semiconductor Manufacturing Company (TSMC) was the first pure integrated circuit (IC) foundry company in the world. Since its founding, the company has been dedicated to providing manufacturing services for advanced ICs. TSMC's success in the foundry business has served as a model for many new entrants to the market.

The solution

In 1987, TSMC began a long-term supplier relationship with Hewlett-Packard. HP provides TSMC with a total test solution, including test systems, data communication and computers to automate the test process. HP also automated TSMC's WAT process, including probe card identification, automatic alarms and other key functions. Over the years, TSMC has purchased dozens of HP semiconductor parametric test systems, a combination of HP 4062 and HP 4071A/SPECS models, for both production and research and development. At TSMC, more than 200,000 wafers per month are tested on HP systems. HP's local support staff has been instrumental in helping TSMC develop test programs, resolve issues quickly and make TSMC's production line more efficient. This has been key to TSMC's ability to reduce manufacturing costs and price its services competitively. "HP has worked with us for many years, and the HP team has intimate knowledge of our operation, including our WAT operation flow," notes Chen. "By leveraging its expertise in computers, communication and test, HP is a reliable partner that provides TSMC with a true competitive advantage."

The Results

Making the switch to HP test platforms meant rewriting existing test programs to run on the HP platform. This would have been a daunting, time-consuming task for TSMC's engineering staff, which had limited test experience when TSMC first was founded. But with help from HP's local support team, the conversion effort was accomplished in a few short weeks. Since then, HP has worked with TSMC to customize test data output formats depending upon customers' unique requirements. "Working with HP's local support staff, we were up and running on the HP platforms very quickly," says Chen. "And, customizing output data formats for a specific customer doesn't slow us down, because HP engineers are there to help." ■

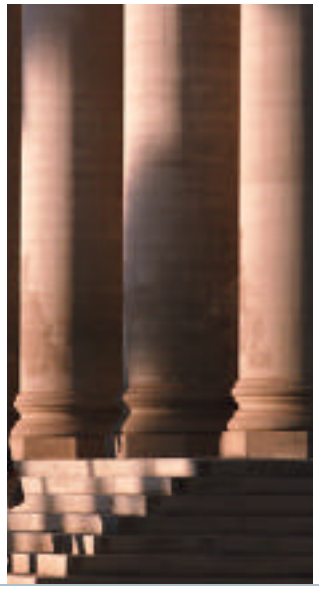
'Because delays in production can result in dissatisfied customers, finding a trustworthy, total-solution partner like HP isn't simply a convenience, it's a competitive imperative.'

— J.B. Chen, Vice President, Taiwan Semiconductor Manufacturing Company

DID YOU KNOW

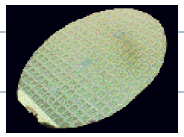
Interesting facts about English words

- No word in the English language rhymes with month, orange, silver or purple.
- "Dreamt" is the only English word that ends in the letters MT.
- The longest place-name still in use is: Taumatawhakatangihangahoauauotamateaturipukakapikmaunga-horonnuupokaiwenuakit a natahu, a New Zealand hill.
- Los Angeles's full name is "El Pueblo de Nuestra Senora la Reina de los Angeles de Porciuncula," and can be abbreviated to 3.63 percent of its size, "L.A."
- "Stewardesses" is the longest word that is typed with only the left hand.
- To "testify" was based on men in the Roman court swearing to a statement made by swearing on their testicles.



products

Memor y



HP introduces HP 95000 HSM Series for high-speed memory test

HP has introduced its new HP 95000 High Speed Memory (HSM) Series, which offers the industry's smallest footprint, lowest cost of test, and the lowest risk test solution available for memory manufacturers.

HP has succeeded in integrating the architectural elements and control functions of a semiconductor test system on a single multichip module.

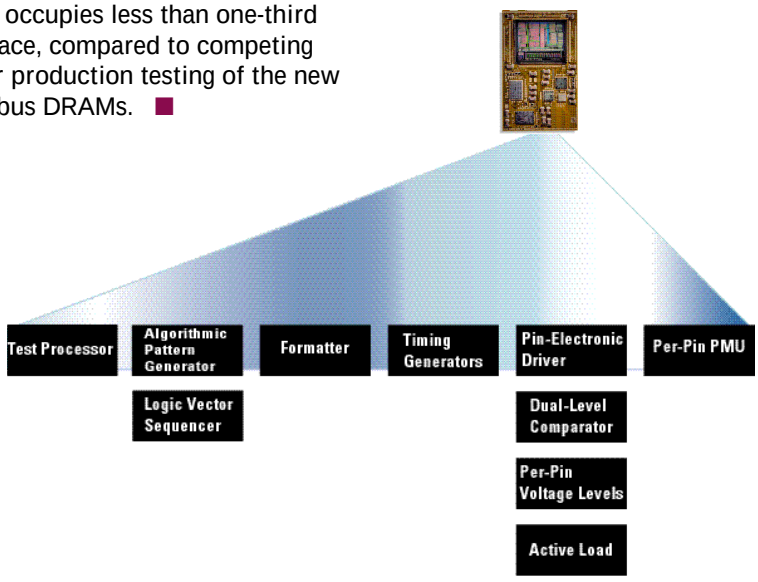
At the heart of this the HP 95000 HSM Series test system is a revolutionary full-custom ASIC, designed and manufactured by HP. This per-pin test processor extends technology developed for previous HP semiconductor test systems by incorporating the algorithmic pattern generator (APG), logic vector sequencer, timing generators, formatters, time set and test control.

The multichip module includes this ASIC, (large die on the right), four smaller ICs and other components to provide essentially a complete test system, for each pin of the device under test, on a 2 cm x 3 cm assembly. An important benefit of this innovation is the fact that the HP 95000 HSM Series occupies less than one-third the floor space, compared to competing systems, for production testing of the new Direct Rambus DRAMs. ■



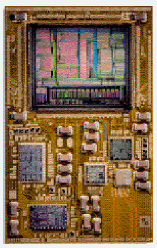
'Build Your Own' version emphasizes the small size of the HP 95000 HSM Series Delta Castle Test Cell.

The new HP 95000 HSM Series test system, configured with a Delta Castle Mx32 Handler, offers the industry's smallest footprint for a complete production test solution for Direct Rambus. And, not just a little smaller, but a lot smaller! To dramatize that point, HP produced a "cardboard cutout" model that also helps customer visualize integration of the tester and handler. Enthusiastically received by attendees at the International Test Conference (October '98) in Washington, D.C., hundreds of the "Build Your Own" test system were distributed to engineers who visited HP's exhibit. To get a personal "Cardboard cutout" copy, contact an HP sales engineer.

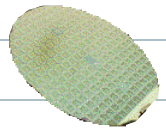




At the ITC Conference in Washington, D.C., last autumn, the HP 95000 was the highlight of the booth display .



Actual size



products

VLSI

Gigabit Ethernet test solution on an HP 83000 platfor m

With the dramatic increase in desktop computing power driven by internet operations and the increasing demand for information bandwidth between network users, a new generation, high bandwidth Ethernet LAN, Gigabit Ethernet, is posed as the network solution for the next century. Early implementation of Gigabit technology will be interfaced to fibre optics and in May1998, its standard was specified by IEEE society as IEEE 802.3z .

Gigabit Ethernet technology deliveries the data stream in 1.25Gbps. The 800ps data cycle requires data transition edge to be in the ps accuracy range in order to ensure the transmission data bit errors rate (BER) less than 1E-12 (10^{-12}). The high accuracy jitter measurement requirement poses a big challenge for most ATE platforms because the small jitter component inherent in the incoming data stream is easily buried by tester noise floor.

In order to fully characterize the jitter components of Gigabit Ethernet transceiver IC, two analog instruments were introduced in HP 83000 platform to complete the Gigabit Ethernet test solution:

-- Smart Timing Analyzer (STA), the low noise floor, high accuracy timing interval analyzer which allows measurement of the jitter component down to 3-6 ps rms with measurement accuracy of 10ps;

-- Smart High-frequency Generator (SHG), 1GS/s arbitrary waveform generator which can be used to provide a jitter modulated data stream with injected jitter resolution <30ps. With HP proprietary Smart Multiplexer Card (SMX), SHG and STA inputs/outputs capability is able to be extended into four differential pairs, enabling multi-port and multi-site device testing. Both instruments are fully supported by HP83000 Smart DSP software, easy to setup and easy to be integrated into HP SmarTest testflow. (Figures 1 and 2 show the mixed signal tool for SHG setup, Figures 3 and 4 show the mixed signal tool for STA setup. Figure 5 is the test function for both instruments.)

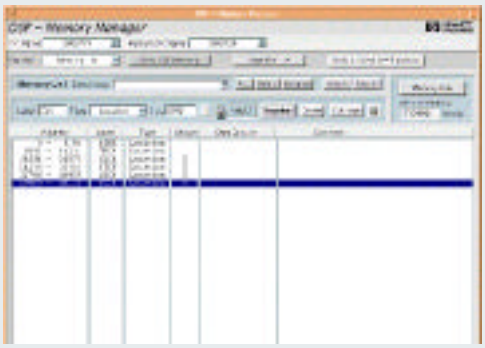


Figure 1

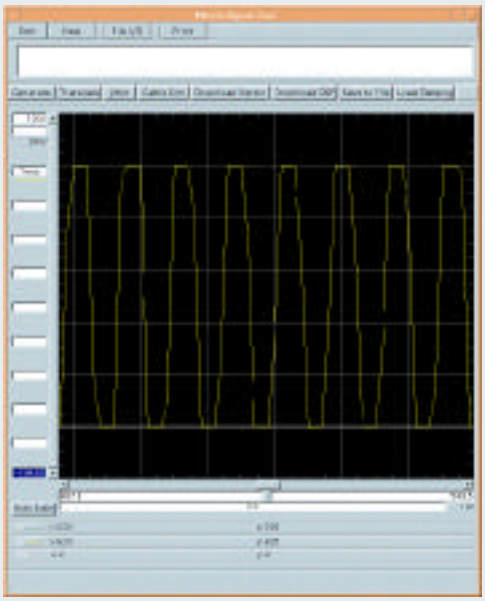


Figure 2

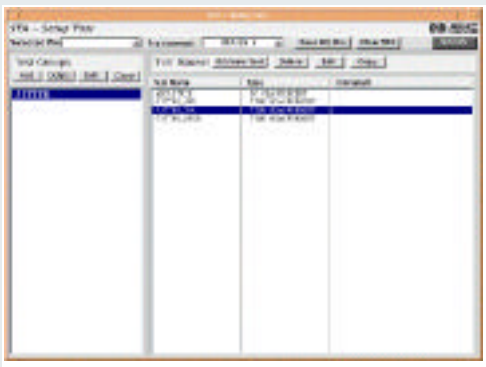


Figure 3

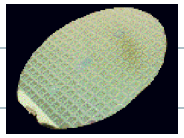
The Gigabit Ethernet transceiver IC includes: transmitter input latch, frame mux, clock synthesizer and output select; receiver signal detect, clock recovery, input sampler, frame demux and output driver. The internal loop back from transmitter serial output to receiver inputs are normally supported. Figure 6 shows the test configuration on the HP 83000 by employing both STA and SHG.

The required jitter characterization tests on the Gigabit Ethernet transceiver are: transmitter intrinsic jitter on serial output (DOUT); jitter transfer from parallel inputs (TX[0.9]) to serial output (DOUT); receiver jitter tolerance on serial input (DIN) and jitter transfer from serial input (DOUT) to PLL recovered clock—while transmitter intrinsic jitter measurement has been requested as part of production testflows.

With appropriate data patterns on the parallel inputs (TX[0..9]), the STA can perform jitter analysis on the 1.25 Gbps serial outputs. Typically K28.7 pattern (1111100000) is used to test random jitter (caused by Gaussian noise effect such as thermal, shot and 1/f noise); K28.5 pattern(0101111001010000011) to test deterministic jitter (contributed by data pattern inter-symbol interference and duty cycle distortion). For deterministic jitter test, the STA is triggered by a digital pin to measure the pulse width of each of the data bits, and the deviation of pulse width from an ideal bit width is calculated as the test result.

The proper characterization of random jitter and deterministic jitter also allows a data eye opening of 1.25 Gbps to be calcu-

Continued on page 13



Continued from page 12

lated by the following formula, without use of external equipment such as BERT or oscilloscope and sacrifice of long test time (> 1E12 [10^{12}] used on BERT to verify the bit error rate of 1E-12):

data eye opening (%) = (800ps - worst DJ - N* RJ) (N=14 for BER of 1E-12[10^{-12}]).

Using SHG as jittered reference clock source (125MHz) to clock the parallel inputs, the jitter is able to be introduced on the serial outputs and measured by STA. HP 83000 SmartDSP software supports sinewave jitter modulation algorithm on the SHG waveform. With a selected set of jitter modulation frequency and amplitude, the test engineer can compare the jitter injected from the source and measured on the output to plot jitter transfer curves.

Typically transceiver IC internal loop back is used to source the 1.25 Gbps data stream to serial inputs due to the lack of >1 GHz source in the ATE production environment. The serial outputs with characterized jitter modulation is looped back into serial inputs, while the parallel data outputs are strobed to check the bit error rate to be within range of <1E-12 ($1x10^{-12}$). The reduced data stream size on serial inputs and stressed strobe condition is suggested to be used to reduce the test time. Meanwhile, the recovered clock can also be measured on the STA to obtain the jitter transfer characteristics for the receiver side.

Summary:

With the introduction of the SHG and STA, HP 83000 system is able to fully test the jitter characteristics of Gigabit transceiver device. It includes intrinsic jitter, jitter tolerance and jitter transfer. The test setup and a production test flow was demonstrated at SEMICON/West '98 on a HP proprietary Gigabit Ethernet transceiver device. ■

Introduction of LAN solution for HP 83000 F330 Series test systems

Rapid growth and expansion, as well as strong competition in the networking market, is driving the semiconductor industry to higher levels of integration in IC design.

The diverse functionality previously found on several chips is now being combined on a single System-on-a-Chip (SOC). LAN controllers will integrate a single transceiver port for use in PCs, or multiple ports for network switches, hubs and routers.

Increased digital complexity combined with dedicated analog and LAN functionality, challenges semiconductor companies to be able to effectively test these new devices. This means having the flexibility to test all functionality and to reduce the overall cost of test in this very competitive market.

With the new HP 83000 LAN Solution, HP offers semiconductor companies, and especially semiconductor contract manufacturing companies, the most complete and flexible solution for production testing of SOC devices. With outstanding performance in digital, analog, memory, high-speed, as well as LAN, the HP 83000 F330 Series with LAN Solution offers a scalable platform with the most versatility, ensuring maximum loading and system utilization.

The HP 83000 LAN Solution combines the performance and reliability of the F330 Series with integrated instrumentation from Wavecrest and Tektronix. This solution is available beginning February 1999, and is very competitively priced. ■

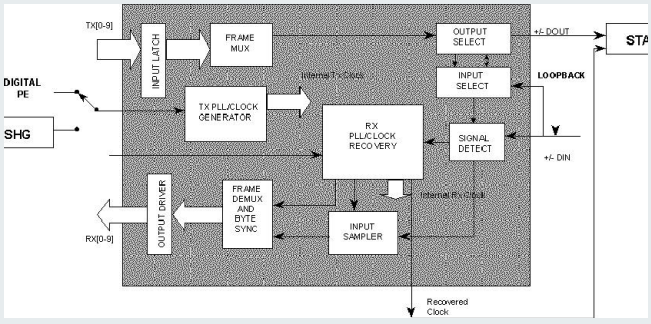


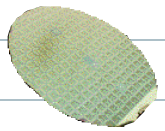
Figure 4



Figure 5

Figure 6





products

Semiconductor Parametric



DID YOU KNOW ?

How tall clouds are—from top to bottom

The tallest individual clouds are thunderstorm or cumulonimbus clouds, which can be 60,000 feet tall, twice the height of Mt. Everest!

A thunderstorm forms when warm, moist air rises and expands. As the air cools, some of the water vapor condenses into cloud droplets, releasing more heat. The added heat causes the moist air to rise still faster.

In a mature thunderstorm, the updrafts can be as fast as 100 feet per second. A single thunderstorm can lift more than 500,000 tons of water into the sky, most of which falls as rain before the storm dissipates.

Unlock the true potential of your HP 4062UX test system

The HP 4062UX test system has always provided sufficiently precise parametric measurements to meet semiconductor manufacturers' process-monitoring needs. As device geometries continue to shrink and speeds continue to rise, however, taking advantage of the system's superior measurement capabilities requires devising new ways to deliver clean signals between the test system and device under test.

Typically, signals arrive at the HP 4062 through an overhead matrix attached to a personality card that the customer has wired to a 4-inch circular probe-card socket. Engineers refer to this type of interface as a "birdcage" because of its nest of exposed wires. Parametric tests must include fast, precise low-current and low-capacitance measurements. Test precision depends on signal integrity, which, in turn, depends on the skill of the person assembling the interface. Excessive leakage current and dielectric absorption can severely limit measurement speed as well.

As an alternative to the "birdcage," Xandex, Inc., has adapted the 4085 switching matrix to allow a direct dock interface between probe card and test system. Xandex performs the installation, completely eliminating the customer's wiring and prober-modification headaches. The interface drops directly into the prober-ring carrier.

The only measurement-path change extends the pogo-pin mounting surface to directly connect the interface and the probe card. The modification, which takes only about an hour, improves low-level capacitance measurements, reduces measurement-settling times, and reduces current leakage. In field tests, the direct-dock interface alone improved low-level capacitance measurements—stray capacitance as well as more stable types—by 10 to 30 percent.

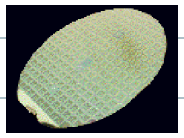
To further protect signal integrity, Xandex has also developed its own high-performance probe card. Designed for both the HP 4071 and HP 4062UX test systems, this card reduces probe-card inventories and eliminates the probe card as a factor in correlating measurements on test floors that employ both machine types. The direct-dock interface and probe-card combination has produced an order-of-magnitude improvement in measurement settling times, permitting much faster low-current measurements.

Xandex currently offers high-performance tester interfaces for all Electroglas probers, as well as TSK APM90 and UF200 probers. Versions for the KLA 1201 and TEL P8 are under development. Contact Xandex for information on other prober types.

For further information, contact Rob Zokaei, Xandex Inc., 1125 N. McDowell Blvd., Petaluma, CA 94954. Telephone: (707) 763-7799 ext. 171, or visit their Website at www.xandex.com. ■

products

RFIC



HP 84000 new software revision A.02.00

HP Introduced a new software revision (A.02.00) for the HP 84000 RFIC series test systems this autumn that not only has features that extend the capabilities of the system, but also has throughput improvements that contribute to reducing cost of test, and enhancements that refine the system's usability.

New features are a very important part of the A.02.00 release; they add incremental capabilities to address emerging test needs for RF components.

New Features
RF on-wafer testing, one of the new features of A.02.00, is used to verify circuit functionality whenever "Known Good Die" (KGD) are required. KGD are used to assemble a variety of components, from multichip modules (MCM) for which high packaging costs dictate high yields to new products intended for plastic packages. On-wafer testing also contributes to faster manufacturing process optimization by detecting device performance problems earlier in the manufacturing process. This early testing also reduces packaging costs and improves packaged part yields.

As RF devices move to higher levels of integration, more than just RF and DC stimulus and measurement capabilities are required in a tester. An optional new digital subsystem for Digital DUT Control is targeted to address these needs of more integrated devices. This optional capability comes in 16- or 32-pin configurations, providing the right level of digital capability to control and test RF/IF wireless devices.

With the growth in GSM, PDC and other TDMA formats, there is an increasing demand to test devices under their true pulsed operating conditions. A.02.00 has a new Pulsed RF measurement Suite that can measure S11, ACPR, Power In, Power Out, Gain and Rise Time under pulsed conditions, insuring product performance for their intended application.
The new and evolving standards for Wideband CDMA will lead to devices in production during the next few years. These devices will require specialized capability for characterization and test. To address this need, A.02.00 offers an optional capability that includes a W-CDMA stimulus and receiver Bandwidths capable of W-CDMA measurements.

Cost of test reductions
Contributing to reductions in cost of test are two new features. The first is a Multisite testing capability. As HP continues to refine the HP 84000's measurement capabilities, resulting in reduced test times, handler index time becomes a bigger part of the overall throughput equation. The new Multisite capability further optimizes throughput by reducing or eliminating handler index time.

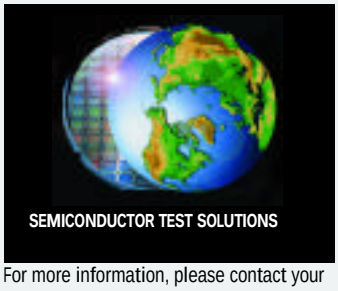
The other major feature that contributes to cost of test reductions is Test Plan Branching. This capability improves throughput by reducing testing done on bad parts, aborting testing after critical failures. Additionally, for parts that meet or exceed certain conditions, follow-on tests can be skipped, again minimizing testing done on these parts. And finally, for devices that have multiple applications, test plans can be branched for different levels of testing, eliminating the need for second pass testing.

A.02.00 Enhancements
In addition to the features listed, here are a number of enhancements that further contribute to the robustness of the A.02.00 software release. Capabilities like Remote Support, Remote Production Monitoring, Histograms and Control Charts refine the usability of the system for both test engineering and production. ■

DID YOU KNOW ?

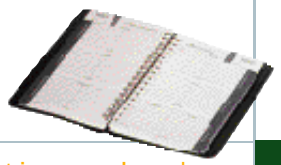
Sales of Bubbly ar e Bubbling

Demand for champagne is expected to increase by almost 25 percent in Britain, France, Germany and the United States during 1999, as the millennium nears. Consumers are expected to welcome the year 2000 with a big bang and a lot of bubbly. Industry experts put the demand for sparkling wine at 300 million bottles, just 25 million bottles short of the worldwide availability. Some wineries are planning to increase the amounts they produce. There also will be an emphasis on distinctive packaging, with bigger bottles and memorable labels.



For more information, please contact your HP sales engineer. Or visit our Website at:

http://www.hp.com/go/semiconductor



global activities calendar

1999 Winter and Spring calendar of events

F E B R U A R Y

[February 23 - 25]

SEMICON/Korea '99
Seoul, Korea

M A R C H

[March 15 - 18]

ICMTS Conference
Sweden

A P R I L

[APRIL 5 - 7]

HP Users' Group Meeting (HUG)
San Diego, CA, USA

[April 13 - 15]

SEMICON/Europa '99
Munich, Germany

J U L Y

[July 12 - 16]

SEMICON/West '99
San Francisco/San Jose, CA, USA

NOTE: Local training on HP's semiconductor test systems is available. For more information, please contact:

United States (1-800) HPCLASS

Canada (1-800) 561-3276

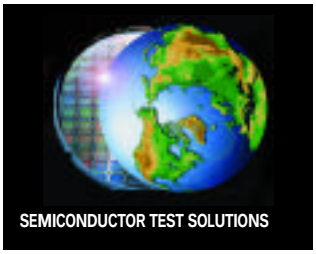
For Asia, Europe, Japan, and Latin America, please contact your local Hewlett-Packard sales office.





- HP Semiconductor Test Factories
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More than 3,500 HP semiconductor test systems are installed worldwide.



For more information on Hewlett-Packard Test and Measurement products, applications or services, please call your local Hewlett-Packard sales office. A current listing is available through AccessHP at http://www.hp.com. If you do not have access to the Internet please contact one of the HP centers listed below and they will direct you to your nearest HP representative.

Semiconductor Test Web site:
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