

Copper Culture

How strong and enduring is company culture?

Broached in a recent *Gilder Technology Report* by Nick Tredennick as he contemplated the incipient war between what he called “the suits and the cowboys” in broadband wireless wifiddles and fiberdoodles, the question arises again as I revisit the enduring miracle of **Micron Technology** (MU) in Boise, Idaho. Celebrated in a recent IEEE study as the owner of the world’s most cited and influential portfolio of intellectual property, ahead of **IBM** (IBM), **Qualcomm** (QCOM), and everyone else, Micron once again is poised to break out into global leadership in semiconductor memory technology.

Also raising the issue of culture is our longtime favorite **Semitoool** (SMTL), a presumptive though unidentified Micron supplier and a kindred cowboy company in nearby (as the jets fly over Glacier National Park) Kalispell, Montana. Both companies are leaders in the most significant on-going development in semiconductor fabrication technology—the move to copper metallization. Requiring a complete transformation of roughly one third of the steps in wafer fabrication, copper affords a cleaner more planar process with higher yields of good die at smaller geometries. It also enables faster and more robust devices. Under the guidance of former Chief Technical Officer, now Chief Operating Officer Mike Durcan, Micron has leapt to roughly a two year lead on the industry in moving to copper for both dynamic random access memory (DRAM) and for Flash memories. No one is saying how they did it, but Semitoool has the only copper equipment in the industry optimized for memories.

It was a quarter century ago that I first stumbled on the fateful name of Micron. I was lucubrating through the night for Ben Rosen and Esther Dyson on the *Rosen Electronics Letter* high in the Pan Am building in Manhattan. (During the daylight hours, Esther reserved her precious Apple 3s for the *PC Letter*, soon to be dubbed *Release 1.0* as Ben went off to found Lotus and Compaq.) Going down a list of a dozen or so elite microchip companies slated to introduce the next-generation DRAM, I discovered the unknown name “Micron,” coming as I recall after **Hitachi** (HIT), the British industrial policy play Inmos and IBM and before Mostek, **Siemens** (SI), and **NEC** (NIPNY). The new chip was to hold an astounding 64 kilobits of information, then enough to carry as much as

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Micron and Semitoool are the leaders in the most significant on-going development in semiconductor fabrication technology—the move to copper metallization.

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It's Showtime for EZchip

Network processor (NPU) guru **EZchip** (LNOP) has begun its initial revenue ramp mainly on the back of sales of its third-generation chip (the NP-2) to Juniper that should continue through this year, followed by sales of NP-3s to **Cisco** (CSCO) and **Juniper** (JNPR) beginning next year. Cisco and Juniper are expected to supply carriers with a huge majority of the Ethernet switches and routers that make up EZ's end market, and CEO Eli Fruchter has burrowed deeply into both companies. Icing on Eli's cake are 74 design wins (still growing) for the NP-2 and NP-3 that span the landscape of carrier Ethernet equipment manufacturers,

include all the leading vendors in China. He expects a significant portion of these products to go into production over the next two years.

Benefiting from nearly a decade of dedicated development, EZchip's products are likely to be more integrated than customer imitations.

In another significant development, EZchip took a step closer to "going public" when, late last year, LanOptics increased its ownership of the company from 60 to 78 percent by issuing LanOptics shares to several EZ shareholders in exchange for their shares of EZchip. Publicly traded LanOptics plans to acquire total ownership of EZchip through similar exchanges with the two remaining EZ shareholders as soon as they are ready to cash out. Since LanOptics's sole business interest is EZchip, the exchange would effectively take EZ public.

With the props set and actors ready, Eli is about to lift the curtain. Look for an investor road show sometime this year followed by the initiation of quarterly conference calls. What's Eli going to tell skeptical investors?

Understudies wanted

At the moment, Eli's message is that he can hold operational expenses near the current run-rate of \$13 million per year, even as the company grows. One way he saves is by educating his customers. In addition to supporting internal research, EZ engineers help customers design Eli's processors into their products. Significant support is usually required for the first design, which can take up to two years to finish. But support for subsequent designs trends downward, nearing zero by the fourth or fifth design. Hence, as veteran customers become EZ experts, Eli can shift engineers to new customers and avoid hiring more engineers.

On the manufacturing side, eSilicon supports all of EZ's needs, from fabrication (**Taiwan Semiconductor**/TSM for the NP-2 and later products) through packaging, and sends EZ the finished product. This relationship is working well, and EZ expects gross margins to hang near 60 percent as sales heat up. Eli's model—gross margin of 60 percent and opex of \$13 million—gets EZ to breakeven on revenue of just \$21.7 million per year or \$5.4 million per quarter.

As much as we applaud Eli's frugality, his razor-thin net cash position of under \$13 million leaves him vulnerable to lost opportunities and nervous customers. He's trying to put on a Broadway hit without understudies. If a veteran EZ customer were to lose one or two of its NP-2/3 experts, Eli would have to rush support to the elder patron while continuing to cultivate the loyalty of newcomers who have committed to their first EZ-centric products.

Unexpected large design wins could further strain the ability of the company to support its customers. NP-2/3 engineers don't graduate fresh out of college; they become experts through training and experience. EZ is a small company, and if it hits a major snag, it could jeopardize products crucial to its customers' survival. For this reason, we believe Eli's partnership with **Marvell** (MRVL) was instrumental to getting him into Cisco.

Eli should bolster his customer support capabilities and energize his development team to ensure future design wins as he buries his challengers under his increasingly superior technology and products. Probably EZ's greatest threat comes from internally developed processors, though several merchant competitors remain: **Xelerated** has announced a few design wins for its high performance dedicated design, but the Xmen still have a long way to go to achieve viability in a market that values flexibility. And **Broadcom-Sandburst** (BRCM) has yet to contrive anything that excels EZ's offerings. As for **Greenfield Networks**, it will more likely turn out to be a Cisco engineering team, implementing boards and line cards bearing EZ technology.

A jumpstart need not be painful. At \$13 per share, Eli can triple his net cash to \$39 million with a public offering of 2 million shares that would dilute share count by just 10 percent to 22 million. Moreover, he can increase spending by almost a quarter and still hold expenses to a mere \$16 million annually. This stab at a more realistic model ups breakeven revenue to \$26.7 million per year or \$6.7 million per quarter and still leaves investors with substantial leverage as EZ's market swells. In fact, leverage improves because EZ can accelerate its technology lead, expand product development, and calm customers concerned about EZ's support and survival—all of which will enable Eli to direct a play that will bring down the house.

And just how big is that house?

Bigger than Broadway

Volume markets are developing for 10-gig NPUs, where EZchip is champion at reading packets, deciding how to distribute them, and converting them to the appropriate protocols at wirespeed. The deployment of broadband and high definition everywhere is accelerating as today's world of television and data moves toward life after television, where video is just another form of data on the network. Every node in the enterprise and metro will have to switch at 10 gigabits per second to handle the seachange from narrowband voice and slow data applications to high-definition video streams.

According to market researcher Linley, high-speed NPUs should grab more than \$250 million of next year's \$750 million NPU market, including both merchant and in-house solutions. In-house chips, however, generally take a long time to develop and are often product specific, problems that EZ's programmable processors solve. In addition, benefiting from nearly a decade of dedicated development, EZ's products are likely to be more integrated than customer imitations. Thus we expect EZ to rapidly overtake its in-house nemeses. Witness Cisco's capitulation on the NP-3.

The NP-2 sells for half the price of EZ's flagship NP-1 processor, but with one to four NP-2s going onto each line card compared one NP-1 per service card, Eli's revenue potential surges by over 10 times per box with his newest processor. Based on NP-1 sales of \$5.9 million during 2005, his top-line potential leaps to \$60 million with NP-2. But it's even better than that because he has increased his design wins by 2.5 times over the NP-1 while his end market bulges. According to Infonetics Research, equipment manufacturers should more than double their revenue in EZ's target markets during the next two years as carriers deploy, in ever greater numbers, the routers and switches in which EZ's critical-path chips will embody the main functionality.

Thus, annual revenue of \$100 million or more by 2009 is

not unrealistic, and could be achieved if the number of boxes that go into production with NP-2 inside increase by only two-thirds over NP-1 boxes. If our model of 60 percent gross margin, \$16 million of opex, and 22 million shares holds, EZ would earn \$2 per share for a stock price of \$60 (at 30 times earnings) sometime during 2009. The story doesn't end there, however. With ultra-wideband and 802.11n, people will shunt high definition images amid other data around their households wirelessly. This might eventually bring NPUs to set-top boxes and residential gateways, an area where Marvell may already be helping EZ along.

Hang tight. It's beginning to look like a long ride up.

— Charlie Burger

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a second of a voice telephone conversation.

Experts regarded this next-generation memory as a supreme test of industrial might that could be met only by government supported giants in Asia and Europe or by global behemoths such as IBM. At the time the memory chip industry was slipping massively, like an Al Gore glacier, toward Japan. Peter Drucker sourly remarked that "making memory chips in the United States is like producing pineapples in North Dakota." Robert Noyce and Andrew Grove of **Intel** (INTC) and Jerry Sanders of **Advanced Micro Devices** (AMD) were assuming Churchillian poses and invoking Pearl Harbor analogies as they implored the U.S. government to bail them out as they resisted the Japanese juggernaut.

Presumably to substitute for the increasingly unprofitable U.S. manufacturing of microchips, Ivied universities and left-leaning think tanks, always helpful, ginned up an exciting new industry of technology monographs, PhD theses, books and articles, classes and speeches by such self-assured and tenured sages as Lester Thurow, Robert Reich, Charles Ferguson, Clyde Prestowitz, Kenneth Flamm and slews of local imitators. They maintained that the Japanese had invented a new form of government guided industrial policy capitalism that would soon bowl over our naïve and archaic free capital markets, unless the semiconductor industry could be subsumed by the Pentagon—which according to these experts was the government force that then accounted for all American technology successes from Teflon and silly putty to the integrated circuit. (Sorry to rub it in with such relish, but I debated these guys hundreds of times over the years and was only occasionally deemed to have won.) In their view, Micron's challenge to the Japanese Keiretsu was utterly doomed and quixotic. After all, as Prestowitz memorably put

it, their chief financier J.R. Simplot "did not know the difference between microchips and the potato chips" that had made his fortune.

When I discovered that Micron was not the subsidiary of some Japanese goliath but an American born entrepreneurial story, I flew to Boise in a snow storm, where the pilot made three attempts to land and narrowly missed the control tower before returning to Salt Lake City. Flying up the next day, I met the founders—the Parkinson twins, lawyer Joe and chip designer Ward, chip layout genius Doug Pittman, and J.R. himself. I discovered that Micron commanded insights into the simpler and more symmetrical design and layout of memories that would give them a more scalable shrinkable chip in each generation. Sure enough Micron's 64-kilobit DRAM was decisively the most cost effective in the industry and established the company in the market. In one of my first interviews, Ward Parkinson explained how Micron's DRAM technology could also be adapted to make a powerful silicon imager. Until recently, Micron restricted itself to crude photo detectors made out of defective DRAMs. But the company's cultural memory persisted long after Ward left. Sure enough, twenty-three years later under swashbuckling CEO Steve Appleton, Micron entered the digital imager market and now commands around a third of it.

I decided to write an entire book on this amazing company. It was published in 1985 as *The Spirit of Enterprise* (now available as *Recapturing the Spirit of Enterprise*). It is still perhaps my favorite among all my works.

The issue of company culture arises because despite the almost complete turnover of executives and designers over the years, Micron still produces decisively the most cost effective memory chips with the simplest and most symmetrical designs. With

Advanced Micro Devices	(AMD)
Altera	(ALTR)
Anadigics	(ANAD)
Broadcom	(BRCM)
Cepheid	(CPHD)
Corning	(GLW)
Energy Conversion Devices	(ENER)
Equinix	(EQIX)
EZchip	(LNOP)
Finisar	(FNSR)
Flextronics	(FLEX)
FormFactor	(FORM)
Hittite Microwave	(HITT)
Ikanos	(IKAN)
Micron	(MU)*
Microvision	(MVIS)
National Semiconductor	(NSM)
NetLogic	(NETL)
PMC-Sierra	(PMCS)
Power-One	(PWER)
Qualcomm	(QCOM)
Semiconductor Manufacturing International	(SMI)
Sigma Designs	(SIGM)
Semitool	(SMTL)
Sprint Nextel	(S)
Synaptics	(SYNA)
Taiwan Semiconductor	(TSM)
Texas Instruments	(TXN)
Xilinx	(XLNX)
Zoran	(ZRAN)

*New this issue

Note: The Telecoms Technologies list featured in the Gilder Technology Report is not a model portfolio. It is a list of technologies that lead in their respective application. Companies appear on this list based on technical leadership, without consideration of current share price or investment timing. The presence of a company on the list is not a recommendation to buy shares at the current price. George Gilder and Gilder Technology Report staff may hold positions in some or all of the stocks listed.

Anadigics (ANAD)

PARADIGM PLAY: ADJUSTABLE LOW-POWER AMPLIFIERS

FEBRUARY 27: 12.00; 52-WEEK RANGE: 5.03 – 13.71; MARKET CAP: 547.77M

Anadigics continues to advance its industry leading radio frequency and process technologies in order to drive its world-beating power amplifiers and tuners deeper into local wireless networks, 3G cellphones, cable television set-top boxes and infrastructure, and broadband links including both fiber and wireless. For example, new power amps for handsets, developed with Qualcomm, reduce power consumption by 75%, for up to 25% more talk-time, by integrating bipolar and field-effect transistor devices on the same die. Inside Intel, Anadigics has been instrumental in helping to set WiMax standards into 2008. And later this year, the company will ramp digital tuners for the upcoming DOCSYS 3.0 cable modems that handle multiple channels simultaneously to increase bandwidth and data rates for digital and high-definition television.

During the December quarter revenue swelled by almost half over the year-ago quarter, to \$49m, and gross margin increased from 26.9% to 34.3% over the same period as Anadigics continued to use more of its leading-edge 6" fab, now operating at 60% of capacity, up from 55% during the previous quarter. Management believes the fab can handle about \$325m of annual revenue and that they will reach that milestone late next year or early in 2009, at which time gross margin should peak at 45%.

With cash, investments, and receivables of \$44m (net all book liabilities) and a quick ratio of cash to current liabilities of 2.6x, Anadigics is strong financially and getting stronger as cash generated from operations continues to grow, likely surpassing the rate of capital spending around mid-year. Uncertain is how or if new fab capacity, which must be up and running in two years, will affect the balance sheet or shareholder value. Management is seriously considering a number of options, including partnerships. They have also filed for the right to raise up to \$100m from stock offerings, which if fully exercised would increase shares outstanding from 45.7m to 54m at the recent stock price of \$12.

Given its expanding share of the rapidly rising teleputer, broadband, and digital media markets and its inside collaborations with the likes of Qualcomm, Intel, and Cisco on products to be introduced as late as next year, we are quite confident in the company's two-year revenue projection. Based on the target gross margin and the trend in opex, the stock could well ascend to \$20 next year and \$30 in two years when earnings reach \$1.54, assuming 50m shares and a conservative price-to-earnings multiple of 20x.

FormFactor (FORM)

PARADIGM PLAY: SINGLE TOUCHDOWN CHIP TEST PROBE CARDS

FEBRUARY 27: 43.34; 52-WEEK RANGE: 34.31 – 49.71; MARKET CAP: 2.02B

Handily beating last year's 40% growth in the advanced probe card market, FormFactor boosted revenue by 55% during 2006 and more than doubled earnings to \$1.58 per diluted share. As we explained in depth in the January GTR, expect more upside surprises through the remainder of the decade as process shrinks, rising package costs and multichip packaging, and shortening production cycles coalesce to make testing an increasingly critical and complex process for semiconductor manufacturers.

The transition to 70 nm DRAM will evolve into a major industry event over the next two years, and Form expects its opportunity to increase by half over the prior, 90 nm tooling ramp. Savings on Form's advanced probe cards are more pronounced where the cost of testing chips is highest, most notably in DRAM fabs, which contribute to more than two thirds of Form's revenues. Helping to further increase Form's share of the DRAM market will be its new family of probe cards designed to handle sub-70 nm geometries on full 300 mm wafers for high-density mobile, commodity, and graphics DRAM. Form has already announced two customers for this product.

NOR flash has also provided Form with a steady stream of orders, and the company is now moving down market into the increasingly complex NAND flash segment where slower chips have traditionally put fewer demands on testing. Management believes its platform is significantly outperforming competing products in early qualifications. Validating their claim is Hynix, which just placed a multimillion-dollar order for Form's advanced NAND flash probe cards, giving the company a huge early lead in this segment of the flash industry.

Expect similar successes in Form's foray into the low-end logic market where devices such as microcontrollers, ASICs, and DSPs are increasingly incorporated into modules and other types of joint packaging for use in products as diverse as cellphones, autos, and game consoles. In multichip packages, one defective chip forces manufacturers to throw out the entire system. Hence more and more of the testing is moving up from the package to the wafer level, creating yet another new market for Form. Also benefiting Form in this segment are embedded devices, such as integrated flash memories, which are lengthening test times. Form expects to introduce its low-end logic line this year as manufacturers cross over to more demanding testing processes.

To meet Form's surging demand, management is expanding and modernizing manufacturing plants in Livermore and in Singapore, where the government is offering the company tax breaks. Last year Form increased capacity by more than half, from \$80m to \$125m per quarter, met its customers' shortened lead times, and still kept \$65m of operating cash flow after capital outlays (free cash flow). Management plans to continue funding all of its expansion from cash flows, including a new factory set to open in Singapore later next

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year.

For long-term investors, a single quarter is seldom significant for Form; seasonality and cycles infect its markets as process generations and testing methods advance stepwise and as consumers time their purchases. Looking at the big picture, management expects its addressable market to increase 25% this year and is hoping to raise revenue by 30% per annum for the rest of the decade while maintaining its record 25% operating margin.

With major paradigm shifts rushing headlong together in the semiconductor test industry, both of these estimates likely fall short, as foreshadowed by last year's results. Based on the "subdued" 30% scenario, by 2009 Form's revenue would rise to \$811m and earnings to \$2.87 per share after taxes, sending the stock into the upper \$60s (at its recent multiple of 24x earnings) some time before that, when investors begin to anticipate the unfolding story.

But don't be surprised if Form soars significantly higher on the wings of more upside surges.

Ikanos (IKAN)

PARADIGM PLAY: VDSL PIONEER

FEBRUARY 27: 8.62; 52-WEEK RANGE: 7.23 – 23.33; MARKET CAP: 238.13M

It's hard to get excited about a business that ousted its visionary founder and fired 10% of its engineers (shortly before Christmas) while revenue and margins were freefalling into a market that is beginning to sprout serious competitors. But maybe we should stir ourselves at least a little, because at its current valuation, Ikanos stands a realistic chance of doubling its market cap even if it does *nothing* but rise with the broadband tide.

Minus sales contributed by the Fusiv line of home gateway silicon acquired early last year from Analog Devices, Ikanos's revenue shrank from about \$30m in the first quarter of 2006 to under \$15m in the fourth quarter, when the access or carrier side of the business descended to a level not seen in almost two years. Over the same period, gross margin dropped from the mid-50s to near 40%, where management is hoping to cling for a while before ascending to their lowered long-term goal of 45%. Helping to fend of a complete disaster was Fusiv, which added some \$40m to last year's revenue.

Some of Ikanos's price and margin woes have come from increasing sales into the gateway market, where competition is hotter. However, some pressure is surely coming from competitive stirrings on the carrier access side, where the company's flagship VDSL2 silicon had until recently been the lonely entrant. At the Needham Conference in early January, Conexant's CEO Dwight Decker claimed that his new VDSL2 silicon (on both the customer and carrier sides) offers the highest port density and has garnered more design wins than his competitors' offerings. He believes these products will help him add to

his 45% share of the DSL gateway market and his huge share of the ADSL segment.

We believe that Conexant and Ikanos may be tied for highest port density and that Conexant may now be faster because it enables bonded VDSL2. But Ikanos probably offers the lowest power per port, a significant achievement. Also at Needham, systems vendor Zhone Technologies told us that it chose Conexant as its VDSL2 silicon supplier based on its own needs, and that it found neither solution to be all-around superior.

Ikanos CEO Dan Adler begs to differ with Conexant and Zhone. As of February, he claims to have seen scant competition and believes that he will win a majority of the VDSL2 deployments this year. By the fall he plans to introduce the first integrated board-level VDSL2 gateway solution, which he believes will lift his margins. Adler boasted that carriers in Korea are aggressively expanding their networks using Ikanos's fourth-generation technology and that they are beginning to order his fifth-generation silicon in preparation for IPTV deployments. Shipments to Japan should begin again later this year when NTT begins building its IPTV network. Also in Japan, Ikanos's 5-gen silicon passed significant qualifications hurdles and Adler anticipates sales for this product to begin shortly. Elsewhere, Ikanos continues to deploy in Europe through Alcatel and Adler believes he has a good shot at winning both of the major North American deployments being planned by AT&T and Verizon.

If Adler can meet his target margins, his company's stock price would nearly double to \$17 (assuming a price-to-earnings multiple of 25) on annual revenue of around \$178m or 75% above the run-rate of next quarter's projected sales of \$25.5m. Even with Conexant, Infineon, and perhaps soon Broadcom on his heels, how can he miss in a market expected to quintuple, based on number of ports shipped, over the next three years?

Intel (INTC)

REMOVED FROM LIST

FEBRUARY 27: 20.03; 52-WEEK RANGE: 16.75 – 22.50; MARKET CAP: 115.49B

Replaced this month by Micron, which affords significantly greater upside.

Micron (MU)

PARADIGM PLAY: MEMORY TECHNOLOGY LEADERSHIP

FEBRUARY 27: 11.90; 52-WEEK RANGE: 11.84 – 18.65; MARKET CAP: 8.98B

With its advantage in copper, Micron leads in a variety of new faster memories. Joining our list this month, it is set to provide a series of upside surprises over the next two years.

PMC-Sierra (PMCS)

PARADIGM PLAY: TELECOM & DATACOM SEMICONDUCTORS

FEBRUARY 27: 6.72; 52-WEEK RANGE: 4.78 – 13.77; MARKET CAP: 1.41B

With last year's acquisitions of Agilent's former storage business and of Passave, the leading vendor of EPON (Ethernet passive optical network) controllers, CEO Bob Bailey may have saved his telco-oriented company from a catastrophic decline. During the second half of last year, PMC-Sierra's older core businesses—which include a potpourri of chips for metro transport equipment, edge switches and routers, networking gear, and wireless base stations—swooned 23%, much faster than even we had anticipated. The traditional lines still contribute to 62% of revenues, and their weakness will likely overwhelm, for at least another year, positive news from storage and EPON.

Worse yet, Bailey has been hit with a huge and unexpected tax burden, boosting his tax rate from the upper teens to the upper 20s. And he may also be encountering some operational challenges; he expects expenses to pop 10% during the first quarter while sales trend flat. If we generously assume that 80% of the rise in expenses is due to the temporary overhead challenges that typically hit at the start of the year, the company would still need to increase revenue to \$480m this year just to match last year's earnings of \$0.28 per share—meaning, Bailey has to beat last year's top line by 13% just to give shareholders a flat deal.

He probably can't do it. Even if he miraculously keeps his traditional lines from declining this year after the first quarter's expected slide, his storage and EPON segments together would need to surge by some 50% for the year in order to boost company-wide revenue by 13%. And the core segment would *still* be generating over half of total revenue. The new businesses may be transformative, but they can't perform magic.

On the EPON side, Passave gave PMC instant dominance in the Japanese fiber-to-the-home (FTTH) market, where NTT has put its network build-out on hold until later this year. With the likely addition of China to the EPON fold, it appears that most of the Far East markets will eventually become potential PMCS customers, but not soon enough save 2007. To bolster his long-term sales in those regions, Bailey has incorporated Passave's silicon in full-featured home gateways, expanding his market beyond the telco side of the broadband link. Unfortunately, outside of the Far East, the rest of the world appears to be heading toward GPON (gigabit PON) networks. We think the simplicity of Ethernet will eventually win out everywhere, but not before the end of this decade at the earliest.

Bailey may be advancing a bit faster into storage, where his Agilent purchase gave him a complete array of low- to high-end storage semis. Lower-end networks are beginning to move from parallel interconnects to serial, where PMC has been winning many designs. Higher up, PMC is heading into the updraft of 4 Gbps storage net-

works with more multiple design wins. As a bonus, the core business will be helped by the ascension of 3G in China, where PMC is supplying chips for Huawei's and ZTE's 3G base stations.

With online applications propelling storage networks, with broadband booming into the rise of IP media, and with 3G wireless ramping, PMC stays on our list. But with the stock trading a bit under \$7, the market is pricing the company at more than 24x our best-case earnings scenario for this year. You can wait awhile on this.

Synaptics (SYNA)

PARADIGM PLAY: ANALOG-DIGITAL INTERFACES FOR HAPTICS

FEBRUARY 27: 24.60; 52-WEEK RANGE: 18.57 – 32.09; MARKET CAP: 640.97M

With its advantage in copper, Micron leads in a variety of new faster memories. Joining our list this month, it is set to provide a series of upside surprises over the next two years.

Reaping early rewards from its grand goal to put its capacitive touch interfaces wherever you find buttons, switches, and LCD screens, Synaptics reported a 39% sequential rise in revenue last quarter. Tripling to a fifth of total revenue were sales into non-PC products, particularly portable music players and cellphones where the company's quick-launch buttons enable easy access to multimedia functions such as music and messaging. In some phones, Synaptics is replacing most of the mechanical buttons with a display that responds to a light touch or movement of the finger.

Also increasing, by 22%, were sales into PC products. Drivers here were the company's flagship touchpads for notebooks along with buttons and controls for notebooks and PC peripherals, including LCD monitors that incorporate buttons and scroll strips for controlling onscreen display and audio, and wireless keyboards with touchpads for cursor navigation and quick access to applications and controls. Synaptics now offers "precision scrolling" which relates scrolling distance on the screen directly to the finger motion on a

touchpad and allows users to accurately move both long and short distances.

Synaptics's ascent appears set to continue. The seasonally weaker March quarter, though forecast to be down sequentially, should exceed the year-ago quarter by almost half as the company drives toward record revenue of \$252m for fiscal year 2007 (ending June), soaring past the previous peak of \$208m reached in fiscal 2005. But don't celebrate just yet. Crashing the party have been rivals offering multimedia products for peripherals, phones, and music players; third-party vendors infiltrating Synaptics's multimedia products (such as suppliers of the LEDs that illuminate the touch sensitive buttons on phones); and consumers enticed by low-end notebooks.

The uninvited guests are eating Synaptics's margins by forcing the company to cut prices while increasing cost of goods and overhead, which includes a growing wave of engineering hires. Thus, earnings for this fiscal year could fall about a dime short of the \$1.23 pocketed in fiscal 2005 despite Synaptics's sales triumph. In an effort to expel its unwanted guests, management has been cranking up its innovation and product engines, hoping to saturate the huge developing markets for mobile and multimedia devices. Helping earnings will be sheer volume along with higher-margin new products, such as the recently announced OneTouch which enables customers to design their own interfaces without having expert knowledge of Synaptics's technology.

At around \$25, the stock is trading about 22x our projected earnings for the fiscal year. If Synaptics becomes the standard name in interfaces in the teleputer and digital media universes as it did in touchpads for notebooks, then the stock should emerge a rising star on our list. The company possesses the technology, talent, and finances to succeed, and the stock could well launch a long-term upward trend beginning later this year.

— Charlie Burger

(CONTINUED FROM PAGE 3)

more capacious cells and fewer layers of metal on the top, Micron's chips are more easily shrinkable than the competition's. Meanwhile, for the entire twenty-five years, Micron's rivals have followed their own company cultures and focused their designs from the outset on creating the smallest memory cells and geometries possible at a particular "process node."

Like a compact car, Micron chips are smaller on the outside and roomier on the inside. Its competitors tend to make chips that are larger on the outside and smaller on the inside. Thus Micron has been able to compensate for occasional lags on the learning curve for manufacturing the next-generation "node" by catching up on the shrink. Their relatively simple and symmetrical devices are easier to reduce to smaller geometries.

Two years ago, Micron diversified from DRAMs by entering the NAND "flash" market at 90 nanometers, which was behind the leaders. A year later the company closed the gap at 72 nm and now believe they have surpassed their foes as the first to sample

a 50 nm, 4-Gigabit chip through their joint venture with Intel, "M-I Flash." They will begin to ramp 50 nm later this year as they continue on their road map toward 25 nm.

In DRAM Micron leads in die size through their 6F² process technology which yields smaller but more capacious cell sizes for a given geometry than their rivals' 8F². Later this year they will be introducing 68-nanometer die for 1-Gigabit DDR2 (double data rate 2) on the heels of their current ramp at 78 nm and 300 millimeter through a joint venture in Singapore with **TECH Semiconductor**. A focus market for DRAM is high-density servers, already a big success story for Micron, with the world's densest server memory module at 16-Gigabyte (stacked) and planar 4-GB modules.

Critical to Micron's advance in servers is its Osmium packaging (a set of assembly technologies), which the company uses for NAND as well as DRAM. In the cache hierarchy for servers, DRAM beds need to move closer to the processor. Thus, the

company is moving toward through-wafer interconnects, wafer scale encapsulation, and redistribution layers, which help Micron increase the speed of their stacking solutions.

RLDRAM (reduced latency DRAM) technology also targets the upper-end of networking, radically decreasing latency by 3.5 times over DDR2 and by almost as much over DDR3 which is not all that much faster. Competing DRAM technologies such as GDDR3 (graphics double data rate) and QDR (quad data rate) were optimized for PCs, which have different demands than networking. Micron is sole sourced on RLDRAM and is just starting meaningful shipments. The technology is also good for home networking, and should see rapid growth.

For mobile applications, Micron has pioneered with proprietary cellularRAM, a type of pseudo static SRAM (static RAM) that has given them about a quarter of that market. They also have SDRAM, DDR, and NAND for cell phones and are starting to release DRAM and NAND combinations in multichip packages, which include controllers, to enable more components in a phone. The product is called managed NAND and it takes complexity out of NAND for OEMs (original equipment manufacturers).

Such advances, however, are routine at Micron and have not halted a fierce sell-off of the stock as memory prices have fallen in recent weeks. The shares are at a 52-week low and are nearing their 5-year low of around \$10 at the very time that the company is breaking through to a two year lead over its rivals in the most strategically significant change in memory chip technology since Mostek put 16-kilobit DRAMs in conventional plastic packages by multiplexing the signals down the pins.

The change is replacement of the aluminum metal wires on the tops of both DRAMs and Flash memories with copper wires. This move to copper metalization was made several years ago on logic chips, where AMD led Intel in the change. While memory wiring is as small as memory transistors, logic metallization lags transistor geometries by a factor of two. With microprocessors moving to 90-nanometer geometries before the memory manufacturers, logic designers encountered the limitations of aluminum for sub-90 nanometer geometries before the memory producers did.

AMD's move to copper

Taking the lead at the top end of the microprocessor market for the first time, AMD attracted our attention (thanks Nick) and went on the list. Crucial to AMD's success was their close collaboration with Semitool, which supplied the electroplating gear that made AMD's move possible in logic. Breaking

through at AMD, **Motorola** (MOT), and several Asian sites, Semitool gained some 30 percent of the copper tool market behind the Silicon Valley leaders **Novellus** (NVLS) and **Applied Materials** (AMAT).

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AMD's move to copper using Semitool gear for its microprocessors set the stage for the company's adoption of copper for its flash memory chips. However, Semitool's existing copper electroplating gear, while cost-effective for logic, priced out at around \$5 per chip. This was far too costly for memories, which often sell at around \$5. In response to pressure from AMD engineer Chris Rader, Semitool CEO Ray Thompson conceived a radical simplification of the electroplating and cleaning cluster-tool that enabled it to keep running through maintenance cycles. With a 24 by 7 cycle, the "Raider" tool became cheap enough to use for memory chips.

In July 2003, Micron shipped its first Raider to AMD's Spansion flash division. Thus Semitool was first in the industry to perfect a system for producing copper wired memories and still commands about 90 percent market share in tools for copper metalization on memories. While logic chips have three times as many metal layers, memories have ten times as many units, driving Semitool down the learning curve with larger volumes, economies of scale, and cost gains. Semitool's dominance in memories is already translating into market share gains for logic as well. Semitool's cost of ownership is about half the competitors'. As Semitool's Kevin Witt puts it pungently, "Novellus has got to pick a hill to die on. We hope they start a price war." Since nearly all memories are now moving toward copper, Semitool's current advantage makes it one of the most inviting companies on our list.

As Semitool gets set to surge through the end of the decade, many on Wall Street appear to be ignoring the big story, focusing instead on a cyclical downturn in the semi equipment industry and on Semitool's forecast for a sequentially weaker quarter. But Semitool's "weakness" is not due to delayed orders, now the bane of its competitors. Instead, the company's sequential slip stems from substantial ship-

ments headed for Japan, where title doesn't transfer until the customer accepts the tool. Thus, Semitool won't be able to recognize revenue from those sales until later quarters. Management foresaw this holdup last fall and still expects revenue to reach \$260–\$310 million for the fiscal year ending September.

Large sequential fluctuations in sales are normal in this industry. Quarters can be particularly lumpy when customers transition to production, buying perhaps four tools one quarter and then waiting several quarters before ordering again. Adding to the lumpiness for Semitool is an industry that is moving to copper in steps rather than in a rush. For instance, Japan is on the threshold of changing to copper in memory, and Semitool is making deep inroads in that country where before it had no business. Korea, however, will not transition until the end of the year and promises to become a major market for Semitool in 2008. Lagging still further is Taiwan, where memory makers will not transition to copper for two more years.

Despite softer revenue this quarter, management expects gross margin to hold near 48 percent as they continue to streamline manufacturing in partnership with a major customer. The new efficiencies are expected to nudge gross margin back to 50 percent over the coming quarters. Also improving will be overhead, helped by declining sales commissions as Semitool transitions to a direct sales force in Asia.

We estimate that Semitool will earn about 53 cents per share this fiscal year based on revenue of \$285 million—a 17 percent rise in revenue over fiscal 2006. That would follow on rises of 28 percent and 36 percent the previous two years. With Raider just beginning a long and healthy ascent into the new copper paradigm, revenue should easily rise an average of 25 percent per year into the next decade. In just two years, that would drive revenue to \$445 million and earnings to \$1.13, equivalent to 46 percent annual growth and resulting in a stock price of \$27 at a multiple of 24 times earnings, just slightly above the average valuation of 22 times for all semiconductor equipment companies.

But don't be surprised to see upsides from there in both earnings and valuation, and for those upsides to continue for years to come as Semitool's multiprocessing prowess and wet chemistry expertise rides into the sub-20 nm future.

With a two-year lead over its rivals and shares trading near a five-year low, Micron is set to provide a series of upside surprises over the next two years.

Also beckoning buy-and-hold investors is Micron. The company broke out of years of serious losses to earn 24 cents in fiscal year 2004 (ending August), 29 cents in fiscal 2005, and 57 cents in 2006. But earnings are set to drop back to the 20s cents this fiscal year with NAND prices plummeting and DRAM prices starting to fall quickly. The price falls will push memory, especially NAND, fast forward into the market, much the way freefalling prices are ushering in the era of the LCD (liquid crystal display) television.

Meanwhile, Micron's Durcan sees the Micron advantage in copper translating into a lead in a variety of new faster memories. After leading the industry in use of chemical mechanical planarization, atomic layer deposition, and its 6F² cell structure, it is set to provide a series of upside surprises over the next two years. With this issue Micron, having significantly greater potential, joins our list, while Intel drops off.

— George Gilder and Charlie Burger
February 28, 2007

Got Questions?

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