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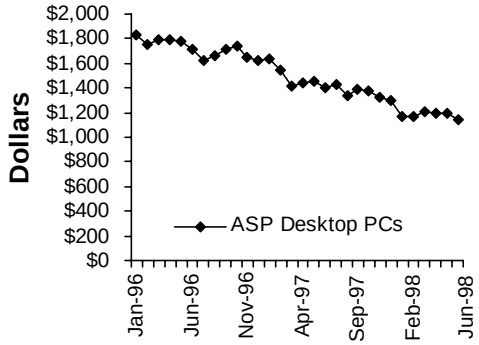
MID-YEAR UPDATE: THE CHIPS ARE DOWN

Microchips in all their forms remain the spearhead of wealth creation in the world economy. Nonetheless, cowering in the haunted houses of Wall Street are frightened men and women conducting a fire sale in semiconductor stocks. All it took to spook the market were the usual cycles of the industry, the perennial dramas of memory chip pricing, the Asian economic crisis, and the flight of investor money from semiconductors into the front-page Internet stocks. None of these events poses any enduring threat to the future of the industry. The rise of the Internet is an unalloyed boon and low memory prices and cheap PCs stimulate the sales of all other microchips. Thus this crash in semiconductor stocks is good news for investors. Several semiconductor companies chosen by the Gilder Technology Report for their Telecosm technologies can be snapped up at bargain prices. In this mid-year update, we offer a review of the opportunities and unrecognized values of these companies' technologies.

Whenever someone in an **Intel** (INTC) cleanroom sneezed, the rest of the industry would get pneumonia. Trouble at Intel meant disaster elsewhere. But times are changing. In retail channels, *non*-Intel processor market share in desktop PCs rose from only 6 percent in January of 1997 to 36 percent by January 1998, with x86 processors now coming from **AMD** (AMD), **IBM**, **IDT** (IDTC), **National Semiconductor** (NSM), and new entrant **Rise Technology**. AMD processor PCs accounted for 26.2 percent of June 1998 retail sales and some 45 percent of sub-$1,000 sales according to PC Data.

Chart 1

Retail PC Average Selling Price



Source: ZD Market Intelligence

When Intel loses share today, PC makers gain profits. Intel margins are shrinking as a result of diminishing sales of super-fast high-end Pentiums. But **Compaq** (CPQ) now realizes higher gross margins from sub-$1,000 boxes than from any other PC line. Compaq is reportedly paying 42% less for home PC components than a year ago, while PC prices have fallen less than half that percentage (Chart 1). With the integration of entire PC systems onto single chips, this trend will accelerate.

National Semiconductor

Already producing the highly integrated MediaGX processor for the Compaq Presario notebook PCs, National Semiconductor is working with major manufacturers on a full PC-on-a-chip, called the MediaPC. Samples will ship this fall and finished product by mid-1999. Benefiting most from this technology will be sub-notebook PCs, which need the size, power, and cost advantages of the single-chip-system. Desktop PCs will also gain from cheaper more compact components. Soon entire PCs will fit in set top boxes, TVs, and other appliances seamlessly networked through a household. National's $122 million acquisition of ComCore Semiconductor, announced April 24, 1998, enhances National's capability in communications ICs. Ultimately single-chip-systems will embrace analog functions. Analog IC sales accounted for 40 percent of National's fiscal 4th quarter revenues and have ridden the crest of the worldwide spread of wireless communications (Chart 2). For fiscal 1998 National's wireless sales grew 74 percent.

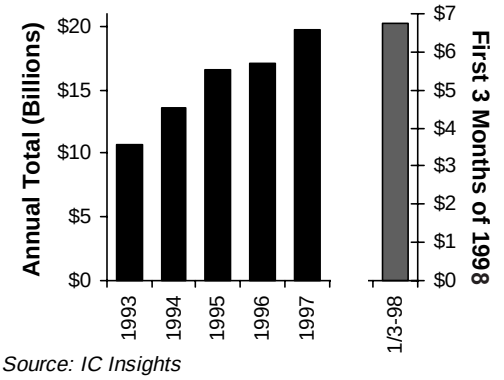
From his previous tenure at **LSI Logic** (LSI), National CEO Brian Halla brought a bold single chip system strategy. Key to carrying it out was the purchase of Cyrix. But the drive to integrate this microprocessor systems company into National's component oriented culture was costly. Beyond these growing pains, the single-chip-system strategy is

bearing fruit. National has released a radio on a chip for cordless phones, and is about to launch a GSM (global system mobile) PCS phone on a chip that integrates all functions except the always treacherous RF power amplifier. Also under development is a chip for the more complex CDMA (code division multiple access) system. Central to the single-chip-radio effort has been National's use of silicon germanium (SiGe) technology licensed from IBM for the higher frequency functions of the chip.

National's use of SiGe for PCS handset chips will be a milestone for this new technology. **Atmel** (ATML) will follow with SiGe technology acquired through the purchase of Temic–Europe's leading pioneer and proponent of SiGe–and will go into production for communications and networking ICs by the end of this year.

Chart 2

Worldwide Analog IC Market



Source: IC Insights

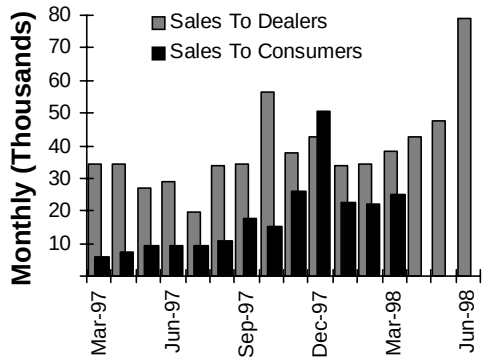
Applied Micro Circuits Coporation

The development of silicon germanium has often centered around relationships between IBM and a handful of sometimes anonymous and mysterious partners. That situation is beginning to change as IBM ramps up to full production capability in its Vermont SiGe fabrication facility. IBM's newest SiGe licensee, **Applied Micro Circuits Corporation** (AMCC), may become one of the most significant. AMCC, under CEO Dave Rickey, is going head to head with **Vitesse** (VTSS), in a battle pitting AMCC's SiGe products directly against Vitesse's GaAs (gallium arsenide) technology. As Vitesse ramps up the world's first 6-inch wafer GaAs fab in Colorado, the company argues that its new $70 million facility will cut the cost premium for GaAs products. But not enough, according to AMCC, to compensate for the cost benefits of silicon germanium.

AMCC's focus on high bandwidth communications technology, including WDM, Gigabit Ethernet and Fibre Channel, combined with their adoption of cost-effective SiGe fabrication for high frequency components, qualifies them as a Telecosm Technology company.

Chart 3

US Stand-alone DVD Player Sales



Source: CEMA, Intelect ASW

Spectrian

All National's SiGe single-chip heroics, however, could not enable it to integrate the power amplifiers that must accurately transmit the signal from base stations into a cell. Ultralinear power amplifiers are the crucial gating element in ascendant broadband wireless uses. **Teligent** (TGNT), **Winstar** (WCII), and **ART** (ARTT) are aggressively pushing microwave broadband in the small business market. And, with both the US and Europe now converging on wideband CDMA for the next generation of wireless, the spotlight moves to the ascendant producers of microwave linear power amplifiers, chiefly **Spectrian** (SPCT) of Sunnyvale, California.

Spectrian has pioneered the production of multicarrier linear power amplification systems for use in broadband wireless base stations. One way to achieve linearity in power amplifiers is brute force, piling up chips until adequate power and linearity result. A better way is "finesse." Spectrian deploys patented dual phase locked loop feed forward correction circuitry to reduce interference and the need for filtering. They use other patented linearization techniques (they have 16 patents, with 25 pending) to alter the RF input prior to amplification, predistorting the signal to compensate for distortion predicted during the amplification process.

With 150 engineers working in the three critical areas of circuit design, DSP (digital signal processor) optimization, and thermal (packaging), Spectrian commands its own wafer fab and can create ICs at low cost. An apparent vulnerability is that some 79 percent of their business came from **Nortel** (NT) and Nortel-Matra in 1997, with **Qualcomm** (QCOM) and **Harris** (HRS) other key customers. The company grew revenues by 15 percent in 1997 to a level of $88 million and by 91 percent in 1998 to some $160 million. Meanwhile, the company ramped up for large orders from Korea, which fell through with the depression in that economy. As a result the stock crashed and trades near the book value of the company. We are not market timers around here, but this seems to be a buying opportunity.

C-Cube

The date is December 27, 1997 and *Titanic*, the most expensive and soon to be the largest grossing movie of all time had opened eight days earlier in US theaters. On the bus between Singapore and Malaka, Malaysia we stop at a travelers' restaurant. Along with exotic satay (amorphous meat on skewers), it offers a stall selling hundreds of VideoCDs, including–for a premium price of about US$5–*Titanic*.

Virtually unknown in the US, VideoCDs are the dominant form of recorded video throughout much of Asia. With some 60,000 titles available, the market for VideoCDs dwarfs the emerging DVD (digital versatile disk) format and rivals North America's VHS tapes. Using superceded MPEG-1 compression, the VideoCDs are notoriously poor in quality, less because of the technology than because of pirated originals copied from prerelease demo tapes, video shot by filming the screen from the audience of a movie theater, or possibly in the case of *Titanic* from an editing tape stolen before final film production was finished.

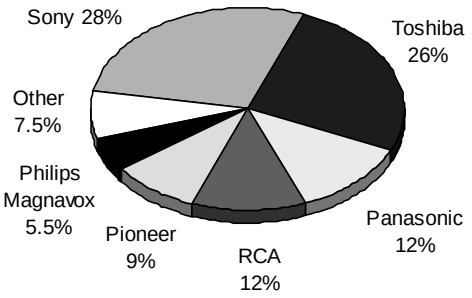
VideoCD players use **C-Cube** (CUBE) technology. Some 61 percent of C-Cube's first quarter 1998 revenue came from overseas, with 52 percent derived from Asia, including 44 per-

cent originating in China, the primary market for VideoCD MPEG-1 decoder products. Looking forward, C-Cube on June 9, 1998, announced partnership with eight leading Chinese consumer electronics manufacturers to establish the next generation of VideoCD, using MPEG-2.

Next comes DVD. With over 1,500 movies now for sale and second generation players now in the stores, the market is moving from early adopters to mainstream consumers (Chart 3). Offering greater capacity and flexibility than a VHS tape, DVD systems will allow viewers to choose between screen formats (TV vs. theater letter-box format), between audio and subtitle versions (mix and match a half dozen languages), pause, skip or begin at any point (no rewinding), enjoy higher quality (some twice as good as VHS, important as screen sizes increase), and even zoom the image, or in the case of recorded sports programming, choose camera angles. In the computer market, high-end PCs now include DVD as a standard component, displacing the ubiquitous CD drive. **HP** (HWP) and other manufacturers are offering free DVD movie rentals through www.**NetFlix**.com as a buyer incentive. And **CompUSA** (CPU) has selected **Navarre Corporation** (NAVR) to provide a DVD movie department in 162 computer superstores nationwide.

Chart 4

1Q98 US Stand-alone DVD Player Sales



Source: Intelect ASW

Having at least six times the capacity of a CD, DVD will puncture the wall which has separated the PC and TV worlds. While LSI Logic is providing the decoder chip for Sony's next generation DVD players, C-Cube claims sales to unnamed DVD manufacturers who have sought anonymity as they use C-Cube DVD decoder chips in preference to their own in-house chips. Also using C-Cube chips and technology will be **Acer**, **Hitachi** (HIT), **Tatung LG Electronics** and **Marantz**.

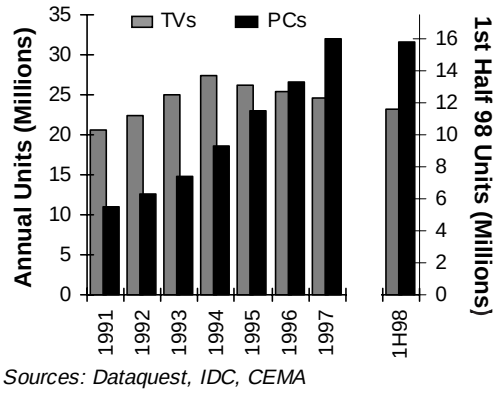
In the PC world, C-Cube has worked with Intel to offer DVD daughter-board solutions for desktop PCs and has partnered with **Toshiba** on notebook DVD chips. C-Cube technology can be found in **Gateway** (GTW), **Dell** (DELL) and **NEC/Packard Bell** PCs along with PC cards by **E4**, **Diamond Multimedia** (DIMD), **Dooin Electronics** and **I-O Data Device**.

C-Cube's DVD strength rests in its encoding prowess. Claiming to be the only company demonstrating a single-chip codec capable of both decoding and encoding DVD quality video, C-Cube is eyeing the recordable DVD market. Plans call for a recordable DVD card which will allow PC users to record video, perform basic editing, and then save the result to the hard drive, email a reduced size video clip or press a DVD disk. Later development will include stand alone DVD player/recorders offering full VCR replacement and finally two-way video communication.

C-Cube hopes VideoCD and DVD revenues will fund development of its faster growing sales of digital video broadcast gear. C-Cube has pioneered single-chip-systems for real-time video encoding and compression and non-linear video editing on the commercial level, and claims most broadcasters use C-Cube technology, mostly from its wholly owned subsidiary DiviCom (founded in 1993 and acquired two years ago). While not specifically addressing the market for cable modems and the data-over-cable market, C-Cube is offering equipment for data casting in which popular web sites, software or other data may be broadcast for near instantaneous use by any user connected to the network.

Chart 5

US PC Shipments Versus TVs



Sources: Dataquest, IDC, CEMA

LSI Logic

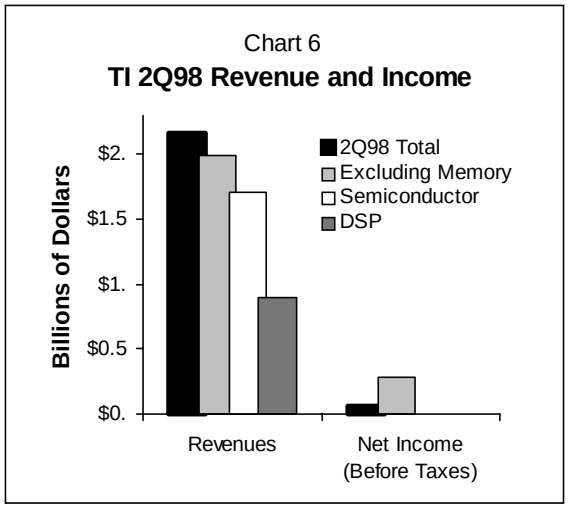
A fast rising rival to C-Cube in consumer video applications is LSI Logic. Indeed, LSI Logic holds the number two position, behind **Sony** (SNE), in worldwide semiconductor sales for next-generation consumer electronics products. Sony has now selected LSI Logic's L64020 DVD decoder chip for its second generation DVD player, following use of an LSI single-chip-system in the market leading Sony Playstation. With over two million transistors, LSI Logic's DVD chip integrates all the key DVD functions, including an MPEG-2 audio/video decoder, Dolby Digital and Linear PCM audio decoders, and sub-picture units, to provide all the advanced viewing features of DVD, along with backward compatibility to VideoCD.

On May 14, LSI logic and the BBC announced joint development of a single-chip demodulator for the European digital TV. The result of a year-long collaboration, the LSI single-chip-system duplicates the functionality of a BBC prototype composed of over 20 chips on a 19 inch rack. Another 12 month LSI collaboration, this time with Europe's **Robert Bosch GmbH**, led to the April 20, 1998 announcement of a single-chip system for digital radio broadcast reception. Bosch will use the technology in digital car radios, and in PC-cards for portable and home digital radios.

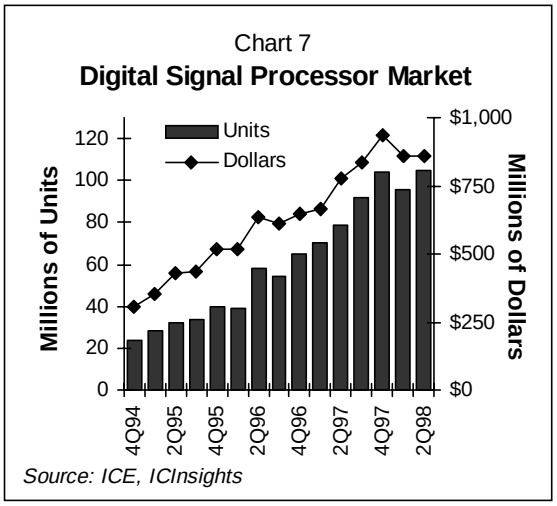
Less than nine months after licensing CDMA technology from Qualcomm and within three months of releasing a comparable GSM version, LSI on April 6 introduced a single-chip baseband processor architecture for wireless phone handsets. Combining an **ARM** (ARMHY) microprocessor, two DSPs, ROM and RAM, ADCs and DACs, transmit and receive filters, PLLs, voice codec, and peripheral interfaces on a single chip, the device reduces the size of the baseband printed circuit board by some 75% and reduces power consumption by up to 38%. Through LSI's design services and licensable cores, handset manufacturers will be able quickly to add on-chip palmtop computer capability, data management hardware, voice recognition software, or display support for video or touch screens.

Highlighted in the August 1997 GTR was LSI's DCAM-101

system-on-a-chip for digital cameras. Adopted by **Casio** on April 6, LSI's low power, low cost device comes at a time of runaway expansion for the market, with PC Data reporting retail sales of digital cameras up over 100% through the first half of 1998. Development efforts by the Atmel-**Polaroid** (PRD) partnership and by National Semiconductor to integrate CMOS (complementary metal oxide semiconductor) image sensors with the camera chips go beyond LSI's use of a discrete CCD (charge-coupled device) sensor, but are not yet available.



LSI's advantage over **Motorola** (MOT) and other later entrants to the system-on-a-chip field is that LSI began with the vision of integrated systems. While Motorola controls thousands of discrete chip designs, LSI has been designing logic cores which were planned from the outset as interoperable modular units within mixed function chips. LSI's CoreWare system allows customers to mix and match dozens of devices in solutions for wireless handsets, digital cameras, hand-held PCs, PDAs, network computers, set top boxes, cable modems, video games, DVD, graphics accelerators, multimedia engines, LAN controllers, routers, disk arrays, drive-on-a-chip, and laser printer engines.



Now, following **Adaptec**'s (ADPT) bid to purchase Symbios, outrageously blocked by the FTC, LSI announced purchase of the company from **Hyundai** Electronics of America for $760 million. Symbios competes with Adaptec in computer I/O (input/output) technologies which enable communications between computers and printers, storage devices, scanners, and a host of peripherals. The new I/O and networking cores and intellectual property gained by LSI, with little overlap to existing offerings, will expand its CoreWare selection and broaden LSI's markets across the consumer electronics and computing industries.

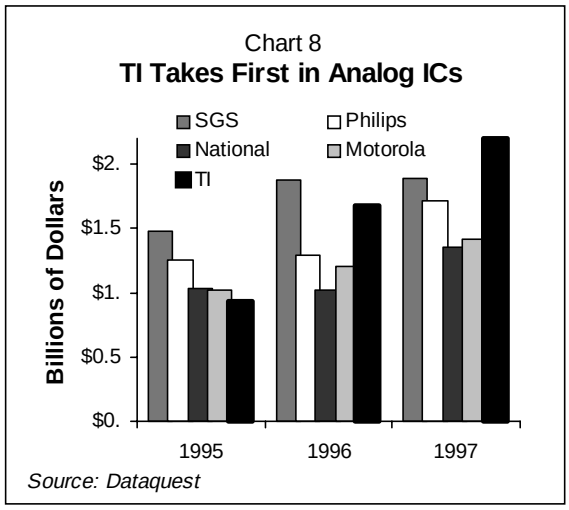
Aggressive in moving to smaller chip geometries, LSI has introduced an industry leading .18-micron process that will offer some 26 million usable logic gates on a chip. Using this technology, LSI will be shipping prototypes later this year and moving to initial production in the second quarter of 1999.

Texas Instruments

On June 18th two great American microchip companies became better still. The sale of **Texas Instruments**' (TXN) DRAM (dynamic random access memory) business to **Micron Technology** (MU) at once enhances Micron's fiercely focused position as the world leader in memory chips and reinforces TI's fiercely focused position as the world leader in digital signal processors. Through a dozen other divestitures and nine acquisitions, TI semiconductor revenues have grown to some 80 percent of sales from less than 50 percent five years ago. DSP revenues are now over 50 percent of semiconductor sales (Chart 6).

DSP is a core technology of the Telecosm. Capable of real-time processing of large data streams, digital signal processors can be found in hundreds of devices from anti-lock brakes and DVD players, hard drives and modems, network adapters and digital phones, to smart radios and the most advanced wireless communications equipment. TI has led the DSP industry since their invention of the technology and holds more than 45 percent market share, more than the next two competitors combined. With worldwide first quarter 1998 year-to-year general purpose DSP chip revenue growth of 29 percent slowing to 11 percent annual growth during 1998's second quarter, there has been a pause in the dramatic rise of the DSP market (Chart 7, Note: Chart 7 includes only general purpose DSP chips and not special purpose integrated solutions and DSP cores). But, TI reports their DSP solutions business maintained 25% year-to-year growth during the second quarter.

TI has also enjoyed growth of its related mixed-signal and analog chip businesses. Texas Instruments' analog chip sales grew 135% between 1995 and 1997, advancing TI from 5th to 1st place worldwide according to Dataquest figures (Chart 8). As annual worldwide unit shipments of digital cellular phones surpass PC shipments, TI has become the leading supplier of DSPs for digital cellular phones, with second quarter wireless revenues reaching record levels. Corresponding to the growth in networking, TI reports it is number one in ethernet desktop switching chips and number one in 56K modem chipsets, with the goal of being number one in high bandwidth ADSL (asymmetric digital subscriber line) modems.

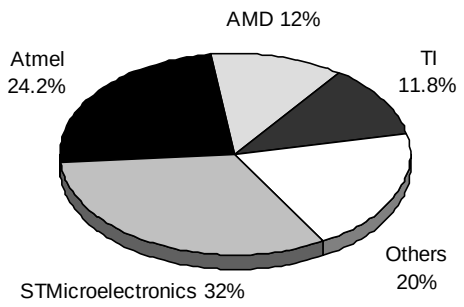


Reflecting TI's skill in semiconductors, radio frequency devices and miniaturization, the Texas Instruments Registration and Identification System (TIRIS) business is steadily growing. Used in automobile security, tollbooth pass, and package and baggage tracking systems, the TIRIS ra-

dio frequency identification system has found great success facilitating fast wireless retail purchases. From a St. Louis trial in August 1996, the **Mobil** (MOB) Speedpass program has grown to 1.5 million motorists using a key-chain bob or car window transmitter to automate their gas pump transactions–pull up, fill up, and go. In February, 1998 a second pump maker, **Gilbarco**, joined **Dresser**'s (DI) Wayne Division in adopting TIRIS, and **Shell** (SC) is testing the system in the Netherlands.

TI memory revenues were $177 million during the second quarter, with losses from the memory business mounting to $222 million. Without the memory drain, Texas Instruments' bottom line, net income after taxes, would have improved some 327 percent from 11 cents to some 47 cents per share. Pre-tax income would have risen from $65 million to $287 million. (Chart 6). In conjunction with the Micron sale and following from TI's other business sales and acquisitions, TI also announced a restructuring program. Eliminating approximately 3,500 jobs, closing some facilities, and generally redefining company functions and operations to match TI's new business focus is expected to save some $270 million. That savings, according to TI, will essentially offset the remaining fixed and allocated costs of the memory business which are not absorbed by Micron.

Chart 9
1997 EPROM Market Share

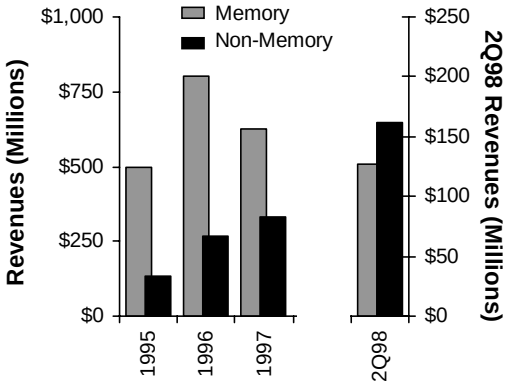


Source: Dataquest

Atmel

Micron refused to buy Texas Instruments' erasable programmable read only memory (EPROM) business. The EPROM industry has for the most part been superceded by EEPROM (electronically erasable programmable read only memory) and flash technologies. And, according to the *Electronic Buyers News*, TI will close its Lubbock, Texas, EPROM fab by the end of the year and is selling off its remaining product. As the EPROM market continues to decline, TI's 12% market share is a prize for other EPROM producers (Chart 9) hoping to stave off declining EPROM revenues. Readers of the April GTR will recall Atmel's success in growing EPROM share and revenue as the market first began to contract. Atmel has expressed interest in again capturing share as TI withdraws. But any EPROM revenue gains for Atmel would be a temporary benefit as Atmel continues to realign away from memory markets and toward its microcontroller, logic and ASIC (application specific integrated circuit) product lines.

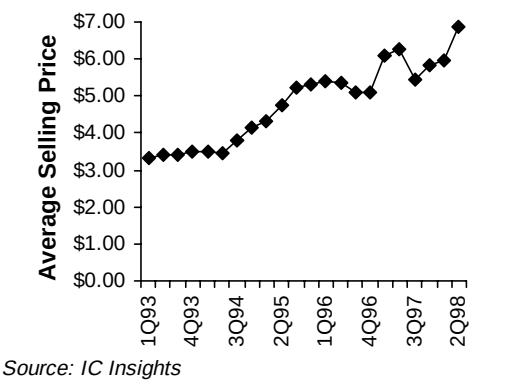
Chart 10
Atmel Product Mix



The strengths of Atmel's non-memory technologies, including programmable logic devices (PLD)/ FPGAs (field programmable gate array), system-on-a-chip, and silicon germanium, were enumerated in the April 1998 GTR. Since that report, Atmel announced a restructuring on June 30, 1998, along with disappointing second quarter results. For the quarter, Atmel's memory business dropped to just 44 percent of revenues and non-memory products favored by GTG grew to 56 percent of its sales, up from just 28 percent a year earlier (Chart 10). Market forces and a vigorous restructuring accelerated the shifts we promoted in April. Unfortunately, Atmel's June 30 balance sheet shows inventories rising to $214 million, up 72 percent from December 31, suggesting Atmel still has a way to go in its product transitions and may experience quarterly disappointments in the near term.

The completion of the Temic acquisition and adoption of its silicon germanium process technology is a significant upside for Atmel. Having begun SiGe operations during the second quarter, the company expects to be in production with its .35 micron silicon germanium BiCMOS (bipolar CMOS) technologies for telecommunications and networking applications by year end. Atmel strengthened its communications and multimedia business with the acquisition of Data Communications Technologies, announced June 22, 1998. Atmel's new UK-based European FPGA design center and its Colorado-based FPGA design center–both with partners–expand availability of Atmel's advanced dynamically programmable logic devices. While the programmable logic device market has seen volatility in unit shipments and revenues, average selling prices have been rising (Chart 11), in contrast to most of the semiconductor industry, as FPGA density, gate counts, and reprogrammability options increase.

Chart 11
Programmable Logic Devices/FPGAs



Source: IC Insights

Xilinx

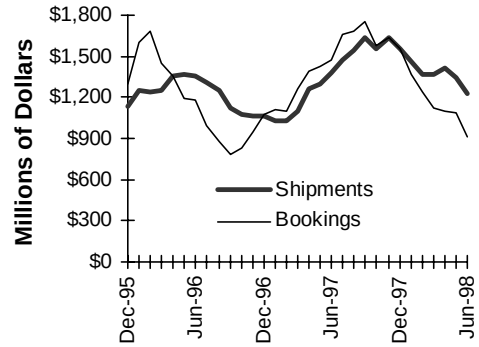
As in design efforts for systems-on-a-chip, the availability of intellectual property cores has become an important aspect of marketing FPGAs. Critical is provision of design tools and licenses required for rapid turnaround of designs and systems. Atmel offers cores aimed toward specific industries and applications, including extensive DSP options for telecommunications, networking, and image processing.

Xilinx (XLNX) now offers over 100 field programmable gate array cores. Xilinx was the first to offer FPGA cores, introducing its LogiCORE program in January 1996. In addition to cores developed in-house, through its AllianceCORE program Xilinx has certified cores from two dozen third-party companies. Xilinx, which was founded in 1984, invented the field programmable gate array and leads in envisioning and implementing the full potential of FPGA systems.

Analog Devices

The Asian financial crisis has had its most dramatic impact not on semiconductor end-use but on the capital equipment spending of Korean and Japanese semiconductor companies. While North American capital spending has been relatively stable, the North American semiconductor equipment vendors have been hard hit by plummeting shipments (Chart 12) to Asia. Even Taiwanese capital spending, previously reported here as relatively stable (July 1998 GTR, Chart 6), is now seeing cutbacks. Among the Telecosm Technology companies, **Analog Devices** (ADI) has suffered significantly from that downturn. "Weakness" in semiconductor equipment market sales of automatic test equipment in Analog's second fiscal quarter turned into a "dramatic downturn" in sales in this third fiscal quarter, ending August 1. The downturn was cited as the primary reason for Analog's July 20 warning of expected third quarter sales declines of 10 percent from the second quarter.

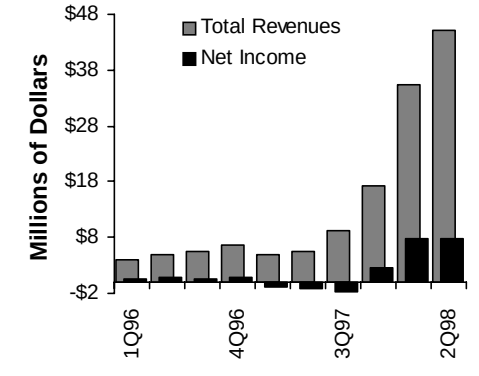
Chart 12
N.A. Semiconductor Equipment



Source: SEMI

Nonetheless, Analog's central product line remains healthy. Over 75 percent of Analog Devices' second quarter revenues came from sales of analog devices, up 25 percent year-to-year. Analog reports a 35 percent market share in the market for converters. Analog's general-purpose DSP revenues grew 16 percent even as the total general-purpose DSP chip market slowed to 10 percent (Chart 7). And Analog has continued apace with introductions of new DSPs during its third quarter. On June 22nd, Analog unveiled its next-generation SHARC DSP, capable of calculating over one billion math operations per second on both fixed and floating-point data. And July 21st, Analog announced nine additions to its family of popular embedded DSP motor controllers.

Chart 13
Broadcom Revenue and Income



Broadcom

Broadcom (BRCM), cable modems. Cable modems, Broadcom. Some six years before there was a Gilder Technology Report, Gilder articles in *Forbes* and the *Harvard Business Review* were hailing cable modems as far superior to the ADSL modems being slowly deployed by telcos. With Motorola reporting on July 27 cumulative shipments of 250,000 CyberSurfer cable modems, and **Bay Networks** (BAY) claiming over 190,000 deployed–installed not merely shipped–by June, the worldwide cable modem total has climbed to some 600,000 units, perhaps ten times the ADSL installations. Shipping 170,000 of their modems in the first 7 months of the year, Motorola claims to have taken the lead over Bay Networks. Focusing on installations, we estimate over 280,000 North American subscribers to cable modem services at the end of the second quarter (Chart 14).

With Compaq stating plans to include cable modems in selected PC models next year, and potentially all models by year 2000, the prospects for cable modem chip maker Broadcom are no longer measured in terms of homes passed, upgraded cable systems, or even online users, but possibly in terms of PC shipments.

Terayon

Alternately rivaling and embracing the cable modem industry's data over cable service integration specification (DOCSIS) standard, **Terayon** has been a favorite of GTR. Using an adaptation of CDMA applied to cable, Terayon has succeeded in expanding the potential of data over cable. Originally designed to broadcast one-way, toward homes, cable systems have required upgrades to allow two-way services. And the bottom 50 megahertz of cables' fat coax can act as an enormous antenna "receiving" interference from garage door openers, CB radios, and all manner of other devices. Using CDMA technology of data coding and frequency spreading Terayon S-CDMA has increased up-stream bandwidth and is able to send and receive error free data across even the noisiest cable systems.

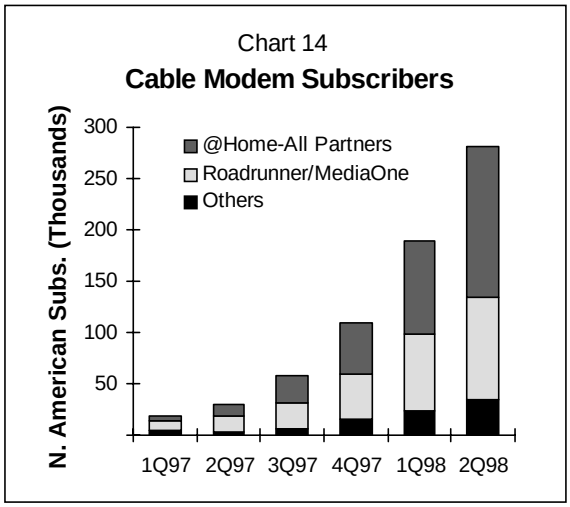
Originally fighting to include its S-CDMA as a component of the North American DOCSIS cable modem standard, Terayon, at first, refused to manufacture to an alternative standard. That original non-compliance, which has been rectified with a dual S-CDMA/DOCSIS compatible modem, cost Terayon in gaining a North American foothold. But Terayon's advantages overseas, where cable upgrades have lagged behind the US, have resulted in a number of significant contracts. Terayon modems are shipping to the Netherlands, Japan, Taiwan, and Canada, where the DOCSIS modem was certified for use on the **@Home** (ATHM) network.

Terayon has filed with the SEC for an initial public offering; the lead underwriters are BT Alex Brown, Hambrecht & Quist, and Smith Barney.

In Other News...

@Home

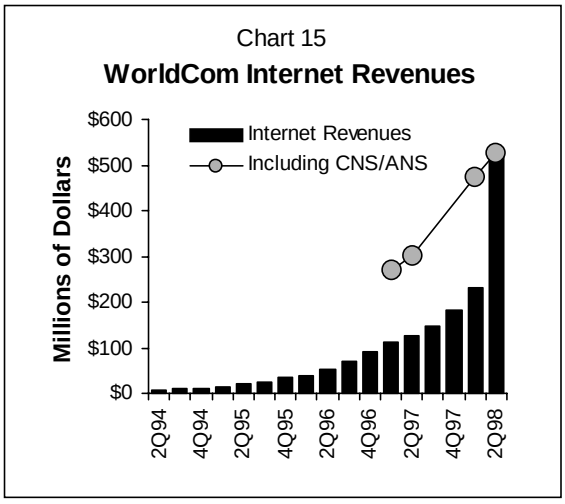
@Home Network saw its shares soar following the June 24th merger agreement between **AT&T** (T) and **TCI** (TCOMA). TCI holds 39 percent of @Home's stock, including 100 percent of the Class B shares–which carry 10 times the voting power of other shares–giving TCI 72 percent voting control. Despite its big stake in @Home, TCI has lagged other partners, especially **Comcast** (CMCSA), in upgrading its systems to accommodate @Home service. In good news for the expansion of @Home, AT&T and TCI have outlined plans for the upgrade of TCI's cable plant for digital programming, two-way voice and 10 Mbps Internet data services. TCI will begin with a $500 million investment before the merger closes and AT&T will put up about $1.3 billion to complete the plan.



@Home expanded its cable modem service to five new markets (for a total of 31) and added 57,000 new subscribers (for a total of 147,000), during the second quarter. United Kingdom and Dutch partners broadened @Home's global reach, with @Home's partners' systems now passing some 60 million homes worldwide following the addition of ten new cable affiliates during the quarter. The number of those homes with access to two-way upgraded plant rose from 5.7 million to 7.9 million.

Applix

The successful launch of Lotus' E-Suite of Java based thin-client applications and IBM's continued strength in leveraging Java solutions has subverted **Applix**'s (APLX) early lead in the Java based application suite market. While Applix reports growing sales for its TM1 real-time analytical processing servers for financial and management reporting, budgeting, forecasting and analysis, declines have continued for its legacy products, and sales have been flat for the Java enabled products previously recognized by GTR. Therefore, by virtue of the erosion of its ascendent technology, Applix has been removed from the Telecosm Technologies Table.



WorldCom-MCI

After utterly ridiculous charges that **WorldCom** (WCOM) was on the verge of monopolizing the Internet, the Justice Department permitted WorldCom to merge with **MCI** (MCIC) only after MCI first agreed to sell both its retail and wholesale Internet businesses to Britain's **Cable & Wireless** (CWP) for $1.75 billion in cash. That's the *US* Justice Department. While the MCI Internet business included substantial infrastructure and customer assets, MCI reports that second quarter Internet revenues were only $89 million of the $1 billion in revenues attributed to MCI's total data and Internet businesses. WorldCom's Internet business remains intact. With a pro forma increase of $51.8 million from the previous quarter, WorldCom Internet revenues rose to $525.5 million in the second quarter or 20 percent of total revenues (Charts 15).

As Cable & Wireless increased its presence in the US Internet market, complementing its strong position in the United Kingdom and Hong Kong, WorldCom announced July 21 the commercial operation of its new pan-European fiber network. The 2,000 route-mile network links WorldCom metropolitan networks in London, Amsterdam, Brussels, Paris and Frankfurt; and will connect 4,000 European buildings, through the Gemini transatlantic cable, to over 27,000 office buildings on WorldCom's US networks.

Level 3

July 20, 1998, **Level 3** (LVLT) announced that **Internext Communications** would share in the estimated $8-$10 billion cost of building its 15,000 route-mile, nationwide fiber network. Internext, newly formed by Craig McCaw's **Eagle River Investments**, **Nextel** (NXTL), and **Nextlink** (NXLK), will contribute $700 million in exchange for fiber and conduit space throughout the network.

P-COM

P-Com (PCMS), in the midst of a temporary downdraft in the microwave radio market, has pursued a strategy of differentiation. Instead of pushing data transfer rates in its point-to-point (PTP) radio line as its competitors have done, P-Com has taken satellite transmission technology from an acquisition and transferred it to its point-to-multipoint (PTM) radio effort. These efforts are beginning to pay off with small volume shipments already going to **Ericsson** (ERICY). These radio transceivers are installed in hubs with 15º sectors, one transceiver to each sector, and each capable of 155 Mbps transmission. This system is fully scalable, and capable of delivering bandwidth on demand to subscribers. P-Com is shipping PTM radios to Teligent this week for testing. P-Com also has an agreement with an as yet unnamed European electronic powerhouse to supply PTM radio systems.

P-Com has been acquiring companies with complementary

ASCENDANT TECHNOLOGY	REPORT(S) Volume: No.	COMPANY (SYMBOL)	Reference Price	Price as of 7/31/98
Cable Modem Service	I: 2, 3; II: 7, 8, 9, 11, 12; III: 6, 8	*@Home* (ATHM)	19 1/2	42 1/8
Silicon Germanium (SiGe)	III: 8	*Applied Micro Circuits (AMCC)* +	22 11/16	22 11/16
Analog to Digital Converters (ADC), Digital Signal Processors (DSP)	II: 3, 7, 12; III: 2, 4, 8	*Analog Devices* (ADI)	22 3/8	21 1/2
Dynamically Programmable Logic, Silicon Germanium (SiGe), Single Chip Systems	III: 4, 8	*Atmel* (ATML)	17 11/16	10 3/8
Single-Chip Broadband Data Transmission	II: 10; III: 3, 5, 8	*Broadcom Corporation* (BRCM)	24 *	62 3/4
Digital Video Codecs	II: 5, 8	*C-Cube* (CUBE)	23	16 1/4
Fiber Optic Cable, Components, Wave Division Multiplexing (WDM)	II: 9; III: 5	*Corning* (GLW)	40 15/16	30 11/16
Low Earth Orbit Satellites (LEOS)	I: 2; II: 1, 3, 4, 8, 10; III: 6	*Globalstar* (GSTRF)	11 7/8	23
Business Management Software	III: 4	*Intentia* (Stockholm Exchange)	29	35 1/4
Wave Division Multiplexing (WDM), Fiber Optic Equipment	III: 5	*JDS Fitel* (Toronto Exchange)	19 1/4	16 3/8
Broadband Fiber Network	III: 2, 3, 4, 8	*Level 3* (LVLT)	62 1/2	81 1/2
Single Chip ASIC Systems, CDMA Chip Sets	II: 8; III: 8	*LSI Logic* (LSI)	31 1/2	20 11/16
Telecommunications Equipment, Wave Division Multiplexing (WDM)	II: 1, 2, 7, 9, 10, 11, 12; III: 1, 2, 3, 4, 5, 7	*Lucent Technologies* (LU)	23 9/16	92 3/8
Single-Chip Systems, Silicon Germanium (SiGe)	II: 8, 12; III: 4, 8	*National Semiconductor* (NSM)	31 1/2	12 5/16
Telecommunications Equipment, Wave Division Multiplexing (WDM), Code Division Multiple Access (CDMA), Silicon Germanium (SiGe)	II: 1, 7, 9, 11, 12; III: 1, 2, 3, 4, 5, 6, 7	*Northern Telecom* (NT)	46	58 7/8
Point to Multipoint System for 7-50 Ghz, Spread Spectrum Broadband Radios	II: 10, 11; III: 7, 8	*P-COM* (PCMS)	22 3/8	5 13/16
Code Division Multiple Access (CDMA)	I: 1, 2; II: 1, 3, 4, 7, 8, 9, 10, 11 III: 4, 5, 6	*Qualcomm* (QCOM)	38 3/4	62 11/32
Broadband Fiber Network	II: 9, 10, 11; III: 1, 2, 3	*Qwest Communications* (QWST)	20 3/8	40 3/8
Linear Power Amplifiers	III: 5, 6, 8	*Spectrian (SPCT)* +	14	14
Java Programming Language, Internet Servers	I: 1, 2, 3, 4; II: 1, 5, 6, 7, 8, 10, 12	*Sun Microsystems* (SUNW)	27 1/2	47 1/4
Broadband Wireless Services	II: 9, 10, 11, 12; III: 7	*Teligent* (TGNT)	21 1/2 *	29 5/8
Optical Equipment, Smart Radios, Telecommunications Infrastructures, Wave Division Multiplexing (WDM)	I: 1; II: 1, 2, 3, 9; III: 3	*Tellabs* (TLAB)	29 1/8	79 9/32
Digital Signal Processors (DSPs)	I: 2, 3, 4; II: 5, 8, 11, 12; III: 3, 4, 6, 8	*Texas Instruments* (TXN)	23 3/4	59 3/8
Wave Division Multiplexing (WDM) Modulators	II: 7, 9, 10 III: 4, 5	*Uniphase (UNPH)*	29 3/8	50
Telecommunications, Fiber, Internet Access	II: 9, 10, 11, 12; III: 1, 2, 3, 4, 7, 8	*WorldCom* (WCOM)	29 15/16	52 7/8
Field Programmable Logic Chips (FPGA)	I: 3 III: 4, 8	*Xilinx* (XLNX)	32 7/8	37 1/2

\+ New Addition * Initial Public Offering

Added to the Table: Applied Micro Circuits Corporation, Spectrian. Removed from the Table: Applix.

Note: This table lists technologies in the Gilder Paradigm, and representative companies that possess the ascendant technologies. But by no means are the technologies exclusive to these companies. In keeping with our objective of providing a technology strategy report, companies appear on this list only for these core competencies, without any judgement of market price or timing.

expertise. P-Com–Italy, comprising two microwave companies, and producing a full range of products for "wireless cable" service providers, as well as a British microwave acquisition, gives the company a strong European presence. Its April 1998 Cylink acquisition along with an earlier acquisition, Atlantic Communications Systems, now P-Com–Florida, produce spread spectrum radios. P-Com is ready to provide radios to the growing worldwide markets for CDMA (and spread spectrum variants in the 2.4 GHz– 5.7 GHz unlicensed bands as well). P-Com is now shipping to service providers, particularly in South America and China. The coming third generation of wireless based on CDMA will find P-Com well positioned to take advantage of this potential major market.

The stock market has not been kind to shares of these cost pressured digital microwave radio companies. Because of lower earnings, P-Com has been forced to sharpen its pencils and produce radios at reduced costs. A new PTP radio in development will be more highly integrated, with fewer components and will bolster P-Com's shrinking margins.

George Gilder and Ken Ehrhart, August 4, 1998

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