IDB-C Ready, Carmakers Aren’t

Six years have passed since Motorola and General Motors first began promoting the idea of an ITS Data Bus standard, yet only this past January were the final published specs made available through the SAE website, www.sae.org. Sadly, while top electrical engineers from the carmakers and some from suppliers spent a great deal of time and effort to develop and promote the ITS Data Bus as a global standard, the carmakers’ vehicle product-line managers are saying, “No thank you, we don’t see the business case.” So far, no carmaker, except possibly a niche truck manufacturer in Europe, has committed to putting an IDB-C (ITS Data Bus-CAN) network into production, even though IDB-C has the support of both AMI-C and SAE. Carmakers don’t understand what IDB-C will do for them or how they will recoup the cost of putting IDB-C aboard each vehicle. Even OnStar, a division of GM, won’t use IDB; OnStar will use a proprietary network instead.

Despite the fact that IDB standard writers accommodated the European preference for a CAN physical layer—the C in IDB-C stands for CAN (controller area network)—German carmakers have never really seen the point of IDB, which transfers data at the rate of just 250 kilobits per second. Rather, they intend to step right up to MOST, a significantly faster network that uses plastic fiber-optic cables. The current version of MOST transmits at the rate of 22.5 megabits per second.

The original idea for IDB was to create a non-safety-critical network for telecommunications and other products that would effectively give OEM and aftermarket suppliers an open platform for their products. A ny product made according to the specs of IDB-C Ready, Carmakers Aren’t

Mobile Electronics Industry Pushes Surround Sound at CES 2002

At the 2002 Consumer Electronics Show held January 7 – 11 in Las Vegas, the Mobile Electronics division of the Consumer Electronics Association made a concerted effort to promote automotive surround audio as the next hot thing in mobile electronics. Last year, rear-seat video entertainment was hot, and it continues hot this year. Stand-alone navigation, however, was a rare sight at CES 2002, as the industry seems to have accepted, for now, the idea that droves of consumers will not spend $2,000 or so to buy those products. Telematics, which the carmaker side of the business expects will eventually bring in big profits, was nowhere to be seen.

The mobile electronics industry hopes that consumers will demand surround sound for their vehicles, given their enjoyment of surround at home and at movie theaters. A s of October 2001, Dolby Laboratories (San Francisco, California), alone had sold over 15 million digital 5.1 decoders, worldwide for home use.

Automotive Surround Basics

Automotive Surround audio brings to vehicles a spacious, enveloping audio presentation like that experienced in movie theaters or in home theater systems.

Surround systems rely on psychoacoustics, the way we perceive sound, to create algorithms, and on digital signal processing (DSP) to make the systems work. DSP can also be used to compensate for the small size of the passenger compartment so listeners can hear all the speakers, not just the one that is closest.

5.1 Auto Surround Systems typically include the following installed components: receiver head unit with six channels of amplification; a 5.1 digital decoder; and six speakers: left, center and right speakers in the front, left and right surround speakers plus a subwoofer in the back. 5.1 refers to the number of separate channels of audio used: one for each of the five main speakers plus one-tenth of a channel comprising just the low frequencies that drive the subwoofer.

Digital Theater Systems (DTS) and Dolby Digital: The two main digital coding methods available to licensees. Most audio hardware manufacturers will purchase licenses to make their audio processors capable of decoding both digital formats, whatever format is used to make the recording.
Electronic Toll Collection Rolls Out in Japan

In 1994 the Japanese Ministry of Construction proposed that electronic toll collection systems be installed on toll roads across the country, to speed up traffic. That rollout is currently underway, but it is going slower than expected. At least nine makers offer, or soon will offer, onboard ETC terminals to consumers, but present prices are fairly steep: typically ¥53,000 ($398), including installation, according to terminal maker, Mitsubishi Electric Company. One reason for the high price of onboard terminals is that they must both transmit and receive. In the U.S., terminals are simple transducers.

Another obstacle is the lack of electronic toll lanes. A according to an engineer from Toyota, only 616 of the 1,300 tollbooths in Japan were equipped with at least one electronic toll lane as of November 2001. Some of those electronic lanes performed no faster, or even more slowly, than the manual lanes, as problems with the systems persist. Recently when coming home from a trip to Tokyo, we found the ETC lanes at a tollbooth near Narita Airport no faster than the manual lanes—traffic was held up in every lane.

Given the start-up problems with ETC, the Japanese government is adding incentives to promote greater adoption of ETC. For example, the Ministry of Transportation has been underwriting a 20% discount for the purchase of an ETC terminal, and the Japanese government has been selling ¥98,000 ($436) tollgate debit cards for just ¥50,000 ($376) each, a 14% discount from the standard toll fee. In the future, as ETC use is expanded for parking and drive-through purchases, the ETC terminal will be seen as more valuable, says a new report from Fuji Chimera Research Institute, a market research firm based in Tokyo.

A according to Mitsubishi Electric, ETC terminals operate in the 5.8 GHz frequency range, transmitting data at 1,024 kbps. System power comes from the car battery; an IC card serves as the external memory.

The charts below on the developing ETC market in Japan are from a 220-page report by Fuji Chimera Research Institute, “Future Outlook of Intelligent Transportation Systems (ITS) 2001.” The report is available only in Japanese; to order or for more information, contact Fuji Chimera by fax at 81-3-3661-6920 or at www.fcr.co.jp/en/contact.htm.

R.L. Polk Survey: Consumers Want Hands-Free Cellular

R. L. Polk & Co. surveyed attendees at the 2002 North American International Auto Show, January 12–21 in Detroit, to learn more about consumers’ preferences for vehicle product features and new technologies. Polk conducted the survey for the benefit of the Detroit Auto Dealers Association and the NAIAS committee as well as carmakers and suppliers.

Below are some of the results from the Interest in Technology portion of the survey. The number of responses in each category was about 4,300.

The Hansen Report on Automotive Electronics

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Surround...

The music recording industry would also benefit greatly if consumers decide they like DVD-surround so much that they are willing to begin replacing their CD collections with DVDs. Over the next five to ten years, more 5.1 DVDs, both remixes and original recordings, will be available through retail sales channels.

This year at CES, multichannel surround sound systems were demonstrated by several mobile electronics and audio technology suppliers including Alpine Electronics of America (Torrance, California); Clarion Corp. of America (Gardena, California); Delphi Automotive Systems (Troy, Michigan); Dolby Laboratories, DTS International (Agoura Hills, California), developer of digital coding technology and producer of DVD-audio discs; Harman International’s Lexicon division (Bedford, Massachusetts); and THX (San Rafael, California), a division of Lucasfilm Ltd.

With organizing help from the publisher of Car Sound & Performance and AutoMedia magazines, CEA sponsored several panel sessions at CES 2002 on mobile surround. Ford was the only OEM represented at the panel sessions. Ford invited both GM and DaimlerChrysler to join the panel discussion, but both carmakers declined to send representatives.

Ford sees big opportunities in mobile surround, both for rear-seat video players and for audio playback. But for the market to really take off, Ford acoustics engineer Mark Naver believes that support from other carmakers is needed to raise consumer awareness of mobile surround.

Steve Ernst, an account manager at Harman International, doesn’t see surround becoming mainstream for another two to five years. He added: “Until less OEMs take up surround sound, it won’t happen in the aftermarket.”

According to Dolby Laboratories, a number of carmakers have already begun installing dashboard-mounted center speakers, anticipating surround systems. Those carmakers include Saab, Audi, BMW, Chrysler, Lexus, Toyota, Cadillac and Mitsubishi.

Matrix vs. Discrete Playback

Discrete 5.1 channel audio playback systems faithfully keep each channel separate, sending each one to the appropriate speaker, which works beautifully in home audio systems. But that can sound strange in a car’s passenger compartment, where the small space tends to trap listeners close to one particular speaker. To compensate, engineers have applied matrix technology, which allows additional signals to be conveyed by altering the phase relationships of the signals. There are available today two proprietary versions of matrix processing. Both turn 2-channel stereo from any source—CD, tape, DVD or radio—into 5.1 channel mobile surround sound. The first to market was Lexicon, a division of Harman International, with its Logic 7 technology. Dolby’s Pro Logic II came out second.

In a few years or so, matrix surround systems will be capable of handling 5.1 discrete channel sources. By that time, the recording industry should be able to offer considerably more than the one hundred, or so, 5.1 music titles currently on the market.

Matrixed 2-Channel 5.1 Surround in Vehicles

So far, Volvo, BMW, Lexus, Acura and Infiniti offer multichannel surround audio systems in production vehicles. Volvo first offered factory-installed surround sound, Dolby’s Pro Logic (with five speakers), in the 1997 C70 sports coupe. Volvo plans to offer a Dolby Pro Logic II matrix surround system on the new XC90 SUV, introduced at the Detroit Auto Show last month.

BMW’s model-year 2002 7 Series, which uses a MOST optical multimedia network, was introduced with surround sound audio based on Lexicon’s Logic 7. Output of the Logic 7 processor can be set up for as many as seven speakers. In a couple of years, Lexicon will introduce technology that handles 5.1 channels of discrete audio and uses matrix technology to compensate for sound problems specific to the automobile.

Ford engineers are also considering including the Logic 7 surround system in the 2003 Lincoln LS. In early January 2002, Lucasfilm THX announced that it was cooperating with Ford to establish THX sound-quality standards for Ford’s automotive sound systems. THX has already established sound standards for movie theaters and for home theaters and has been working to bring that quality to premium vehicles.

Music and Video

Surround is a natural fit for rear-seat movies and can also entertain music lovers in the front seat. We listened to various surround demonstrations at CES and found most of them noticeably more exciting than conventional four-speaker stereo systems. One explanation is the way these systems were demonstrated. Audio volume was usually high, and the source material was attention-getting—for example, car racing or a car chase scene from a recent movie—lots of tire squeals and throaty accelerations. But even the music recordings we listened to were more impressive in surround than they would be on standard factory-installed stereo systems.

Dolby Headphones

While the industry is pushing surround speakers both for rear-seat video entertainment and car music, it’s not clear why the driver would have any interest in listening to noisy soundtracks from DVD movies the kids might be watching in the back seat. Rather than listen to the car’s speakers, the kids could use headphones with Dolby Headphone, proprietary technology from Dolby that emulates multi-speaker surround sound. That would leave the speakers free to play surround audio programming for the driver and front-seat passenger.

While at CES we watched and listened to a clip from the movie Red Planet on headphones playing Dolby Headphone software. The Dolby Headphone signal sent from the receiver to the headset had been digitally processed to create the effect of five virtual loudspeakers placed in a virtual room; a subwoofer signal was mixed into the two rear virtual channels. We were impressed with the spatial quality of the sound and the sense that the action was moving all around us.
The Company Profile... Hitachi Semiconductor

Background
Hitachi Semiconductor is a subsidiary of Hitachi Ltd. (NYSE: HIT). Founded in 1958, Hitachi Semiconductor is one of the world’s leading global electronics companies, with consolidated sales of ¥8,417 billion ($7,286 million) for FY 2000 (ended March 31, 2001). At the end of September 2001, Hitachi Ltd. had 1,069 subsidiaries, with 337,975 employees (73% work in Japan). With headquarters in Tokyo, Japan, Hitachi Ltd. manufactures and markets a wide range of products including computers, semiconductors, consumer products, as well as power and industrial equipment.

Strategy
Serving primarily tier-one and tier-two suppliers, Hitachi Semiconductor’s automotive markets include North America, Europe, Japan and Asia. Hitachi’s automotive customers worldwide are migrating out of 8-bit solutions in favor of higher-performance 16-bit and 32-bit microcontrollers. Since automotive application requirements are very similar worldwide, Hitachi can leverage its investments worldwide, an advantage in creating high quality, low-priced products, according to the company.

"Over the past decade, Hitachi Semiconductor has developed a leadership position with our 16- and 32-bit product lineups,” explained Christopher Cook, director of the Hitachi Semiconductor Business Unit.

Hitachi Semiconductor is a subsidiary of Hitachi Ltd. (Tokyo) and a leading manufacturer of semiconductors, with 1,069 subsidiaries, 25,000 employees, and total sales of ¥903.5 billion ($7,286 million) for FY 2000. Hitachi Semiconductor is a leading supplier of microcontrollers, microprocessors, discretes and custom linear products, as well as CISC (complex instruction set computing) microcontrollers, RISC (reduced instruction set computing) microprocessors and memory components.

Strategic Focus
Hitachi is supplying components to carmakers since electronics were first used in the car. The company continues to have a long-term commitment to support the automotive industry. Hitachi microcontrollers are today used in dashboards, climate control systems, ABS and traction control systems, airbags, engine and transmission systems and car infotainment solutions (CIS), such as navigation, telematics, digital audio broadcasting (DAB) and mobile phones.

Hitachi Semiconductor Sales
FY 2000 Sales: ¥903.5 billion ($7,286 million)

- System Memory: 9%
- System LSI: 48%
- Multi-Purpose Semiconductors: 25%
- DRAM: 18%

Hitachi is the world’s largest supplier of 16-bit micros with 22%, followed by Mitsubishi, 19%, Motorola, 12% and several others. Source: Gartner Dataquest, April 2001

2000 Worldwide Microcontroller Market Share, All Markets

- Hitachi, 14%
- Motorola, 15%
- NEC, 11%
- Toshiba, 6%
- Mitsubishi, 10%
- Microchip, 3%
- STMicro, 4%
- Infinion, 4%
- Fujitsu, 5%
- Matsushita, 5%
- NEC, 3%
- Others, 23%

Hitachi Semiconductor Sales By Product

Address: Nippon Bldg., 6-2, Otemachi 2-chome, Chiyoda-ku, Tokyo 100-0004 Japan.
Tel: 81-3-3270-2111; website: www.hitachisemiconductor.com

Hitachi Semiconductor (America) Inc.
Address: 179 East Tasman Dr., San Jose, CA 95134; Tel. (408) 433-1990; Fax (408) 433-0233; Hitachi Semiconductor (America) Inc. is a subsidiary of Hitachi America Ltd., which is a subsidiary of Hitachi Ltd. (Tokyo).

FY 2000* Semiconductor Sales: ¥903.5 billion ($7,286 million)

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- STMicro, 4%
- Infinion, 4%
- Fujitsu, 5%
- Matsushita, 5%
- NEC, 3%
- Others, 23%

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Founded in 1958, Hitachi Semiconductor Group had sales of ¥903.5 billion ($7,286 million) in FY 2000 or about 11%
Hitachi Automotive Products

- SuperH RISC microprocessors
- Embedded H8 and H8S CISC microcontrollers and microprocessors
- Memory ICs including SRAMs
- Flash cards
- Logic ICs
- Discrete devices
- Communications ICs
- RF/wireless ICs

Hitachi’s Automotive Applications with Greatest Growth Potential

- CIS, Telematics and Navigation Systems: Most such applications employ 32-bit microprocessors. Since the amount of total memory required for complex CIS, telematics, and navigation systems is too great from a cost perspective to integrate all of it on chip, some memory resides off the microprocessor as external components. (More details on CIS and navigation systems follow.)

- Powertrain Systems: Hitachi runs some low-end engine control systems with high-performance 16-bit devices, but today 32-bit microcontrollers primarily run powertrain systems. Hitachi’s SuperH RISC family has a high degree of integration and embedded memory; its latest microcontroller for powertrain has 1 MB on-chip flash memory, 48 KB RAM, 80 MHz operating frequency, and greater than 100 MIPS (million instructions per second).

- Advanced Safety Systems: This important product area for Hitachi Semiconductor is centered in the U.S., mainly around advanced airbag applications. In the U.S., crash and rollover detection, as well as tire pressure monitors, are hot new features. As developers integrate crash-detection and rollover algorithms into advanced airbag systems, microcontrollers will move from 16-bit to 32-bit architectures. Globally, Hitachi expects to lead the market for micros in airbag systems. The company is competing for a share of the global tire-pressure-monitor market—the good news there is that tire pressure monitor volumes are expected to be huge.

- Body Control Systems and Instrument Cluster Systems: These two automotive applications rank about equally in importance to Hitachi. Both areas are moving from 8-bit to 16-bit and 32-bit microcontrollers.

Important Future Products

While CIS, navigation and telematics are among products that hold the greatest potential for future growth, the company also expects to see sales growth from advanced safety systems, advanced powertrain control systems, network gateway systems and electric power steering (EPS). While EPS is currently bigger in Europe than in the United States, EPS will ramp into high-volume production in the U.S. within the next two years, according to Mr. Cook.

Dominance in Japanese Navigation

Hitachi has had the lead position in microcontrollers and microprocessors for Japanese car navigation systems since 1999, with greater than 70% of the market, including 60% of CPU and companion IC chipset sales. In 2000 in Japan, nine out of ten major navigation system makers selected Hitachi’s SuperH series microprocessors or graphic accelerators. While the Japanese navigation market, with 25% penetration, is slowing, Hitachi intends to take its navigation system solutions to other regions.

“Unfortunately, we do not see navigation growing quickly in the United States because of the price, which typically is $2,000,” reflected Mr. Yamamoto. “If we can lower the system price to less than $500, which is exactly what is happening in Japan now, we think it will explode in the U.S.” The navigation market in Europe is picking up faster than the U.S. but systems there are also expensive. Hitachi believes increased peripheral integration will help reduce overall system costs and grow the market in Europe and the U.S.

CIS: Telematics, Multimedia Applications and Navigation

CIS applications include telematics, car multimedia and navigation.

Hitachi Semiconductor Major Customers

Listed Alphabetically

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<th>North America</th>
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<td>ASL/Takata</td>
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Europe

- Becker
- Bosch
- Sagem (Acquired by Johnson Controls Inc. in October 2001)
- SiemensVDO
- Temic (Now part of Continental)
company believes that by 2005, it will have greater than 60% of the worldwide market for microprocessors and companion chips used in car infotainment systems, as well as a 9% market share of telematics applications. In 1998, Dataquest gave Hitachi a 70% share of the worldwide market for CIS microprocessors.

Characterized roughly by region, CIS breaks down as follows: Navigation is very important in Japan, car multimedia features are important in Europe, and telematics is seen as a driver of sales in the United States. CIS customers worldwide come to Hitachi for the same reason customers in other markets come to Hitachi: Their application requirements demand high performance microprocessors and microcontrollers. For CIS, that means 32-bit RISC micros.

The company believes it has established a CIS/telematics de facto standard with its SuperH family, and it expects the SuperH-4 RISC processor, the HD64404 companion chip, and multiple low-cost, single-chip derivatives to become the de facto CIS/telematics standard worldwide.

Aimed at the CIS market, the new HD64404 companion chip works with the SuperH-4 RISC processor. HD64404 features include a high-performance graphics engine, video/audio functions and interfaces, communication peripherals and a digital display driver. The HD64404 optimizes the routing of different data streams and provides a clear separation of CPU functions from operations handled by the graphical module, and that results in improved bus efficiencies.

Experts agree that the timing for when telematics and car information systems will ramp up has been pushed out as much as three years from projections made just one year ago. A problem in advancing telematics, ventured Mr. Yamamoto, is that service providers’ systems are proprietary so third parties cannot provide content. Mr. Yamamoto suggested that some problems are regional in nature. For instance, the Japanese telematics market does not have killer applications or content, nor is content secure. In the United States, where safety and security have a high value, more telematics services are available than in Japan.

Hitachi products support mobile phones and digital audio broadcasting, which can carry not only audio, but also text, pictures, data and even videos—all on wireless channels. While the introduction of DAB has been delayed in Japan from 2001 to 2003, DAB growth in Europe is strong as receiver prices have been reduced. In the United States, DAB is just beginning, according to the company.

Hitachi CIS Partners

Similar to the way Hitachi got into the navigation market early in Japan, the company is working at the early stages of the CIS market with a number of service providers around the world. In addition to OnStar, Hitachi is working with other service providers in the U.S. market.

Hitachi says it supports all popular CIS platforms available globally today; its microprocessors are compatible with all major operating systems. Hitachi is discussing with Microsoft the next-generation Windows CE for an automotive platform. The existing platform is already compatible with 32-bit SuperH RISC microprocessors.

Hitachi embedded processors are compatible with numerous operating systems including Wind River Systems (VxWorks and PSOS), Aecelerated Technology (Nucleus), Microware (OS-9), QSSL (QNX), Lineo (Linux), LynuxWorks (LynxOS, Linux) and others. QNX, VxWorks and WindCE are used in navigation and car multimedia applications. Linux is more popular in the U.S. than in Europe or Japan; VxWorks is popular in Europe. Widely used in Japanese navigation systems, µTRON operating systems are also compatible with Hitachi products.

To date, different telematics computer platforms have been used in different regions, but that may be changing. Hitachi Semiconductor is working with Toyota, and the carmaker is working with OnStar on a Japanese-U.S. telematics venture that may have multi-regional implications.

Hitachi Semiconductor is working to support Java and other middleware with IBM/OTI, Sun, HP, Tao and Insignia. In speech recognition, the company is working with IBM, Fonix, ScanSoft (formerly L&H) and others. Middleware enables more telematics and infotainment features, such as echo cancellation, noise suppression and MP3 playback. Hitachi says Java will be included in most telematics systems because service providers want to offer their applications to anyone, regardless of the computer platform on board.

In Europe, Hitachi is working on navigation, telematics and car entertainment with Becker, Bosch, SiemensVDO and others. In the United States, the company is working with Becker, Delphi Automotive Systems, SiemensVDO and others. In 2001, Delphi and SiemensVDO announced their selection of the Hitachi SuperH 4 CPU and Hitachi’s new HD64404 companion chip for their next generation CIS systems. This in-car multimedia solution will integrate audio, navigation, communications, video, entertainment, safety and security capabilities in vehicles debuting around 2003.

The HD64404 is the first companion chip to combine a high-performance graphics processing engine with standard connectivity (such as CAN, MOST and others, plus two external buses) in a single chip. The companion chip is scaleable with upward code-compatible SuperH processors to allow the reuse of software from previ-
ous systems, and that means a shorter time to market for system developers. The growing inventory of middleware products being developed today will allow SuperH and HD64404-chipset implementations to be readily tailored for some applications via software rather than hardware.

Products with Greatest Potential for Future Automotive Sales
(Not ranked in order of potential)
◆ Integration: SOC (system on chip) solutions targeted at navigation, CIS and telematics—taking a core processor and integrating many of the peripherals for the system around that processor
◆ Higher-performance ASSP (application specific standard product) versions of 16- and 32-bit microcontrollers
◆ New microcontrollers using high-density embedded flash memory

Integration, Higher Performance and Cost Reduction
In vehicle control and, in new, but expensive systems like navigation, Mr. Cook explained, "What is really driving cost improvement are process-related enhancements and our ability to move down to the .25-micron and .18-micron technologies." The goal is to get the costs low enough that OEMs can afford to use high-performance microprocessors and embedded flash microcontrollers in high-volume production.

Hitachi is not just driving down costs for OEMs by reducing chip size but also by integration, reducing the number of chips. "Typically, applications in which you see a lot of integration concentrate on logic functions where process and design issues are less complex than with the integration of mixed signals," noted Mr. Cook. Hitachi is taking a core processor and integrating the peripherals for systems such as navigation and telematics around the core processor. Hitachi’s current system-on-chip solution for the automotive industry uses packaging that has 352 pins. That’s a big packaging and assembly challenge for the auto industry, and one that will continue as semiconductors increase in performance while decreasing in size.

Advantages of Flash Memory
The company estimates the trend in automotive applications for embedded memory is moving from over 90% masked ROM, and less than 10% flash memory in about 1995, to equal use of ROM and flash by about 2008. Flash advantages include:
◆ Lower OEM costs: fewer microcontrollers replaced to change software code as flash allows easy updating
◆ Greater flexibility: software programs loaded into flash memories at the end of the OEM manufacturing cycle
◆ Significantly reduced lead times for implementing new software code
◆ Fewer device part numbers for OEMs to deal with; better for inventory management
◆ Changes to software do not require vehicle manufacturing stoppages.
◆ Software can easily be changed to respond to customer and market changes after the vehicle is purchased: No need to remove the electronics module from the vehicle
◆ Significant reduction in liability and obsolescence costs related to software code problems
◆ Potential for maintaining, correcting, upgrading and adding software in the vehicle via wireless communications

Flash Memory
Several years ago, Hitachi recognized the importance of providing customers with embedded flash memory to update or reprogram their software code on-chip. Today Hitachi Semiconductor is the world’s largest supplier of embedded flash microcontrollers with a market share of 36%, followed by Sanyo, 28%, Mitsubishi, 12%, and a few others. The company also has the world’s largest share of embedded flash microcontrollers for the automotive market.

Currently, microcontrollers with on-chip flash memory are in mass production at Hitachi Semiconductor for all industries. Hitachi has already shipped over 200 million units of embedded flash microcontrollers across four generations of flash process technologies, with over 20 million units shipped for automotive applications.

On-chip flash memory is organized in blocks of varying KB size. That permits erasing of individual flash blocks allowing very selective reprogramming. The SH 7055 micro supports a destination-address change mode that allows any of the eight 4 KB-sized blocks of flash memory to be mapped into RAM, a flexible alternative that makes development of calibration parameters much easier.

The newest flash process technology decreases flash access time: With a memory access cycle of 80 MHz, access time decreases to 12.5 ns at .18um compared with 25 ns at .35um and 40 MHz. Volume production shipments of Hitachi’s 0.18um embedded flash microcontrollers will begin ramping up this year in automotive powertrain applications.

The number of write-erase cycles of flash technology is now more than 100 times and new technologies on the horizon will up the number of cycles to significantly more than 10,000. These new flash technologies will also begin to replace system EEPROM, currently used for non-volatile storage of variables. Moreover, Robin Blanton, technical manager of the Hitachi Semiconductor (America) Automotive Segment, told us that the company will also begin to use wear-leveling algorithms that spread the write-erase cycle wear over a larger memory area to significantly increase the effective number of write-erase cycles.

Growth of Hitachi Embedded Flash Micros for Automotive Applications
By Shipments, by Year

Hitachi believes it has shipped more embedded flash units for automotive than any other company, partly because its products have high reliability in the harsh automotive environment.
What's Best?

It’s hard to get audio and acoustics engineers to quantify exactly how much better a particular format is compared with others. We wanted to know how much better 5.1-channel surround sound systems are, compared with two-channel (stereo) tape or CD playback systems. After some gentle arm-twisting, one prominent audio engineer ventured his personal view. Dr. David Griesinger, who invented Lexicon’s Logic 7, reverberation and home theater technology, said, “If tape systems are given a 1, then CD systems might get a 1.25; 5.1-channel, DVD-Audio surround systems would score a 2.5.” According to Dr. Griesinger, going from two to 5.1 channels has significantly more impact than increasing the amount of data that is transferred from the tape, CD or DVD to the audio processor. For example, the DVD-Audio format transfers data at the rate of 2.3 megabits (96 kilohertz sample rate times 24 bits per sample) per channel, compared with CDs, which transfer at the rate of 706 kilobits per second (44.1 kilohertz times 16 bits per sample) per channel. “There is a lot more information coming from DVDs than CDs, but the difference is so subtle that it is difficult to hear,” said Dr. Griesinger.

Similarly subtle and hard to distinguish is the difference between discrete 5.1 playback systems and matrix 5.1 systems. We listened to Clarion’s demo playing 5.1 discrete surround audio in a vehicle with an installed Joyride system. While the Joyride demo was impressive, we thought the 5.1 matrix systems sounded just as good. Joyride is Clarion’s Windows CE for automotive computing platform. Clarion had hoped to bring out 5.1 surround when it first announced Joyride, at the 2001 Consumer Electronics Show but developing a robust system that could handle navigation, radio, CDs and DVD audio surround proved more complicated than expected. It took a digital signal processor specialist an extra year to make the system robust enough for Clarion. Joyride with a Dolby 5.1 digital audio decoder has been available in the U.S. market only since January 2002.

<table>
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<th>U.S. Mobile Audio Market</th>
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<tr>
<td>2001 Total Market $4.99 Billion</td>
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<td>2000 to 2001 Growth: 2.5%</td>
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<td>OEM $2.78 billion</td>
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<td>Aftermarket $2.21 billion</td>
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<td>Source: Consumer Electronics Association</td>
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Promoting Surround

CEA began promoting automotive surround sound at the 1999 Consumer Electronics Show when it put together a small roundtable meeting on the subject. About that time, CEA and Dolby built a Pro Logic surround system that was installed in Technocar, a demonstration vehicle that CES brought to various news outlets in the United States. Dolby Pro Logic surround was designed to play back auto surround to five speakers: the four speakers already installed in most vehicles plus the all-important center speaker, mounted up front. More recently, Dolby developed Pro Logic II, designed for six speakers.

CEA will continue to promote surround audio, both in the aftermarket and among carmakers. For example, CEA members want to encourage more carmakers to prepare a space on the dashboard so the aftermarket, or new car dealers can safely install center speakers, a prerequisite of surround audio systems.

Last summer, to help educate audio enthustiasts to the pleasures of mobile automotive surround, DTS International, of Acura Hills, California, in cooperation with Car Sound & Performance, sponsored the first ever DTS 5.1 surround sound competition at USA C (United States Autosound Competition International), a leading autosound sanctioning body. While interest in this first competition was modest, USA C was able to present a competition that yielded first, second and third-place finishers.

IDB...

It could easily be plugged into the IDB network. A carmaker’s proprietary network and safety-critical vehicle control systems would be kept safe from the ITS network by means of a firewall or gateway. Carmakers would use the gateway to strictly control access to the vehicle data bus. Suppliers would gain limited access to the vehicle bus by signing contracts with each carmaker and maybe paying a fee for the privilege.

According to its promoters, IDB would yield great benefits to the whole industry—carmakers, dealers, the aftermarket, OEM suppliers and especially to consumers. Consumers would benefit by gaining access to a wide assortment of new, affordable electronics products, which could easily be replaced when newer products came along. Just as the adoption of Microsoft’s standard disc operating system, standard connectors and memory storage devices benefited the entire PC industry, adopting IDB would help the car electronics industry respond more quickly to consumer demand. Without such standards, carmakers risk losing customers to other industries, such as the mobile wireless device industry, should other industries offer consumers better products at lower prices.

Today the IDB Forum, which promotes IDB-C networking in the vehicle, has 35 members, including founders Alpine, Delphi Automotive and Motorola, and full members DaimlerChrysler, (the only carmaker), Denso, Fujitsu Ten and Texas Instruments. Other carmakers have kept involved through AMI-C, which is also a member of the forum. Membership costs up to $10,000 per year, for companies with more than $100 million in sales. One IDB player said recently that he and others now intend to promote IDB-C to the mobile electronics aftermarket.

More on IDB can be found at the website www.IDBforum.org.