# FUTURE HORIZONS

Presents

# Semiconductor Application Markets Report


## 2010 Edition

### Annual Analysis & Forecast Of The Worldwide Semiconductor Application Markets

# Future Horizons

# The Semiconductor Application Markets Report 2010 Edition

## Annual Analysis & Forecast Of The Worldwide Semiconductor Application Markets

- **EDP**
- **Telecommunications**
- **Consumer**
- **Industrial**
- **Automotive**
- **History From 2004-2008**
- **Forecast For 2010-2014**


Future Horizons

**www.futurehorizons.com ◊ e-mail: mail@futurehorizons.com**

Future Horizons Ltd, 44 Bethel Road, Sevenoaks, Kent TN13 3UE, England

Tel: +44 (0)1732 740440 • Fax: +44 (0)1732 740442

Affiliates In Europe, India, Israel, Japan, Russian, San Jose California, USA

In Russia, Call Future Horizons' wholly-owned subsidiary East-West Electronics, Moscow, Russia Tel +7 495 228 0766

# Annual Analysis & Forecast Of The Worldwide Semiconductor Application Markets

Please note that content is representative only and based on 2009 Content. Some Details May Differ

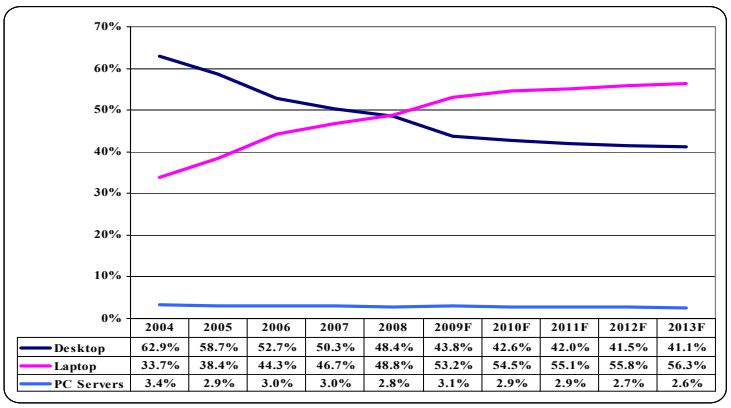
# Personal Computers (PCs)

On the positive side is the growth of the use of PCs by less developed or newly industrialised countries such as China, Eastern Europe, India and Russia. These countries have a high and in most areas, well-educated population who are able to use PCs, particularly desktops for business. Longer term, it is anticipated that PCs for these regions will be manufactured locally, using some local manufactured components.

There is a continued adoption of more features on PCs due to the introduction of Bluetooth and IEEE 803.11 wireless LAN (W-LAN) and the forecast use of WiMAX and Ultra Wide Band (UWB) wireless USB links from the beginning of 2008 onwards. As discussed there is also a trend towards more mobility of computer users and this is reflected in an increase in the percentage sale of laptop/notebook computers, Figure 1.5.

These laptop PCs, of which mainly two subcontractors, Compel and Quanta in Taiwan, manufacture the large part of the world supply, now incorporate Bluetooth and/or W-LAN as standard, giving a small additional revenue or some small differentiation for the PC manufacturers. It has also kick-started Taiwan as a wireless LAN as well as PC chipset supplier.

**Figure 1.5 – Worldwide PC Production by Type, 2004-2013**
(Percent of Units)




| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009F | 2010F | 2011F | 2012F | 2013F |
|---|---|---|---|---|---|---|---|---|---|---|
| Desktop | 62.9% | 58.7% | 52.7% | 50.3% | 48.4% | 43.8% | 42.6% | 42.0% | 41.5% | 41.1% |
| Laptop | 33.7% | 38.4% | 44.3% | 46.7% | 48.8% | 53.2% | 54.5% | 55.1% | 55.8% | 56.3% |
| PC Servers | 3.4% | 2.9% | 3.0% | 3.0% | 2.8% | 3.1% | 2.9% | 2.9% | 2.7% | 2.6% |

Source: Future Horizons

# PC Graphic Processors

This reduction in suppliers has not only occurred because companies have pulled out of the market, but also by acquisition, with ATI (now part of AMD) taking ArtX, Nvidia taking 3Dfx, Via Technologies taking S3 and Creative Technologies taking 3DLabs (although this still exists as a brand name and re-launched as a separate company).

Companies supplying the desktop sector of this market in 2007 are segmented by PC model, Table 2.2.

**Table 2.2 – Competition by Sub-Sector In Desktop GPU Market, 2008**

| Entry-Level PC | Midrange PC | High-End PC |
|---|---|---|
| Intel | ATI Technologies/AMD | 3DLabs/Creative |
| Silicon Integrated Systems (SiS) | Intel | ATI Technologies/AMD |
| S3/Via Technologies | Nvidia | Matrox |
| XGI | Xbit Labs | Nvidia |

Source: Future Horizons

This market positioning is not permanent with previously high-end suppliers such as 3DLabs and previously entry-level suppliers, such as SiS both making a play for the mid-range sector in earlier years.

In 2004 both Intel and ATI gained some market share from Nvidia as these companies concentrated on the integrated GPU for the faster expanding laptop market.

# Personal Digital Assistants

**Figure 3.1 – Blackberry Personal Digital Assistant (PDA)**


Source: RIM/T-Mobile/Future Horizons

For most users a PDA does not replace a PC but runs alongside it, being updated by an updating or 'synchronisation' programme used when the carrier connects to the office network. In this way, both the PDA and the PC have up-to-date diaries and data at the beginning of each day.

**Industry Trends**

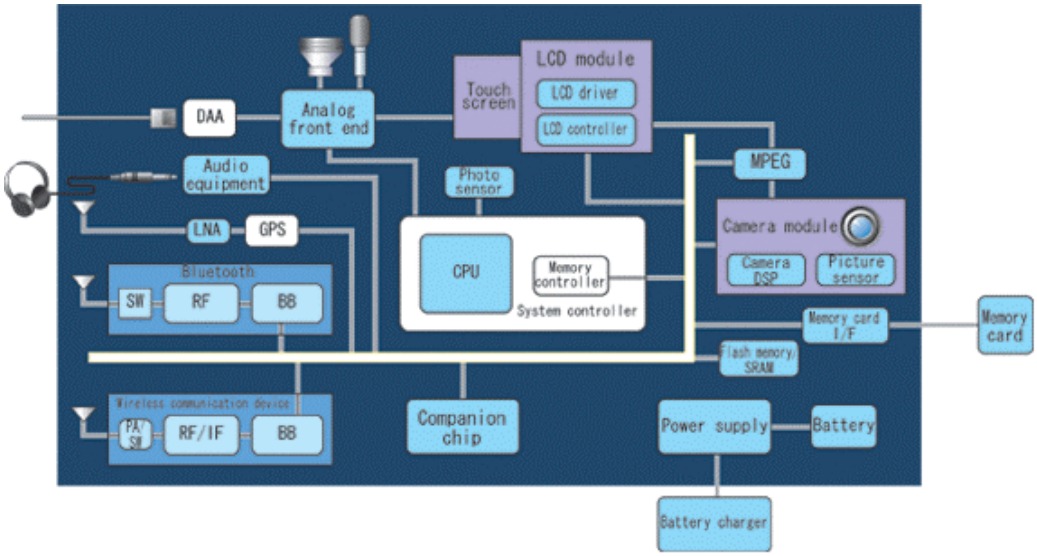
Although Apple abandoned its pioneering Apple Newton PDA, other early developers of PDAs such as Casio and Sharp are still in the business, although one early supplier, Psion, decided to withdraw from the consumer market during 2001 in what has become a very competitive sector. Apple started selling the Apple iPhone mobile smartphone during 2007 and this has many PDA-like functions.

Other early PDA suppliers are Compaq (now merged with Hewlett-Packard), and PalmOne, plus newcomers Acer, Asus, Agenda, Compaq, Dell, Dopod, HandEra, Mitac International, Mio, NEC, Research In Motion (RIM) with its Blackberry

# Personal Digital Assistants

**Figure 3.3 – Block Diagram Of A Basic PDA**




Source: Toshiba/Future Horizons

The core processing power now comes from a low-power, low-price 32-bit microprocessor with those supplied by ARM, MIPS, Freescale (The DragonBall), Samsung, Toshiba and Renesas and STMicroelectronics (both from the SuperH-4 core design). A recent arrival and a good seller in top-end models is the Xscale processor originally from Intel, and now owned by Marvell. In modern designs the CPU carries out both communications baseband tasks and also operates as an applications processor.

Most of the input and output electronic functions, such as UARTs, infrared, LCD and buzzer drivers are now being incorporated into the microprocessor-based System-On-Chip (SoC).

On the microprocessor rides an operating system, as mentioned earlier. These PDA orientated operating systems are lightweight and are only a few percent as

# Smartcards

## 4 Smartcards

### Description

The Future Horizon's definition of a smartcard includes both memory and microprocessor based chip cards.

#### Memory Cards

Memory cards are contact or contactless chip cards or IC cards that are the size of a credit card and have an IC memory embedded. This memory is typically EEPROM. Contactless memory cards normally conform to a standard specification called MIFARE or ISO14443. Contact memory cards are normally built to the ISO7816 standard. Memory cards do not have an embedded processor on board but some cards have additional logic for security and encryption.

On-chip memory comes in three sections; Read Only Memory, (ROM) - for permanent information - up to 320KBytes; Random Access Memory, (RAM) - for fast scratchpad use - up to 16KBytes; and Electronically Erasable Programmable Read Only Memory, (EEPROM) - for updating - up to 64KBytes. EEPROM is the working data area and can contain anything from a few tens of bits to 64Kbits, depending on the application.

Typical memory-type cards include pre-pay telephone and transport cards, some low-data health cards, and access/security control cards. All cards can be hardwired to specify the security level of data the reader is allowed to access, but if security is paramount, the more expensive microcontroller-based cards are necessary.

#### Microcontroller Cards

Microcontroller cards have similar external specifications and standards to the memory card and can be the size of a credit card or in a smaller format that is

# USB Flash Drives

## Technology Trends

### Flash Technology

A flash-memory cell is like a conventional transistor with an extra gate. Between the source and drain and the control gate, there is a second 'floating gate', which serves as a charge storage mechanism. Thin layers of oxide isolate the floating gate from everything else.

When a sufficiently large programming voltage is put across the source and the control gate, electrons tunnel through the oxide layer and accumulate in the floating gate. This process is called 'channel hot electron injection' and the extra negative electron charge in the floating gate raises the cell's turn-on threshold by increasing the negative potential opposing voltage. This writes a 'zero' in the cell, instead of the stored 'one' of the erased uncharged cell.

Erasing the cell reverses the process turning the cell back to a 'one'. By grounding the control gate, and bringing the source to the programming voltage, this removes electrons from the floating gate and reduces the turn-on threshold.

This operation takes quite a long time because the relatively high voltage it requires - at least 10 volts - entails a good deal of current. Since there are limits to how much current chips can handle, there are limits to the number of cells that can be erased at once – that is why erasing occurs in one group of cells at a time.

### Different Types of Flash

The common method of referring to flash technologies is by the logic scheme they use. The competing schemes are NOR, which is used in code-executable areas in PC and mobile phone baseband applications and NAND, which is used for higher storage capacity applications such as add-on memory in cameras, the multimedia section of mobile phones USB flash drives.

Memory density is the strength of NAND technology, which is supplied by Toshiba, Samsung, and others. It connects the cells serially, with a select gate for

# Flash Memory Cards

Source: Olympus/Lexar Media/ Sony/SanDisk/Future Horizons

## Industry Trends

Flash Memory Cards are sold direct to the public as electrical items through electrical stores, camera shops, mobile phone shops, mobile phone operators, via the Internet, or direct from the manufacturers.

Kodak and Lexar Media have formed a long-term agreement to work together to gain market share in this very competitive market. Kodak's brand strength and distribution channels, and Lexar's memory card experience will compete with the other fabless supplier and market leader SanDisk. SanDisk has recently acquired another large fabless supplier M-Systems. These fabless companies have their NAND chips made by other manufacturers such as Infineon and Samsung. Other leading removable flash memory card suppliers are Toshiba, Sony, and Renesas.

### Flash Memory Card Applications

#### *Digital Still Cameras*

The digital still camera was one of the earliest uses for flash memory cards and still accounts for a reasonable consumption. Each camera comes with a small amount of built-in flash memory at purchase, but this is usually of fairly nominal size – 32-64Mbytes - and does not allow the purchaser to take more than a dozen photos.

As most camera users like to have the ability to shoot over 100 high-resolution mode photos this mandates the purchase of a flash memory card for storage. The capacity needed depends on the megapixel resolution of the camera and the choice of resolution by the user. For example, a 10MP camera has the capacity for 400 high resolution shots Table 6.2.

# Flash Memory Cards

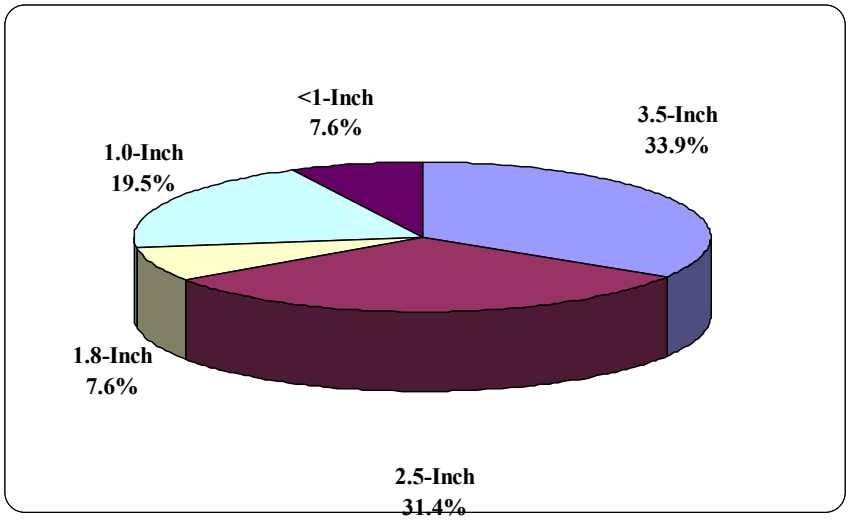
**Market Drivers and Assumptions**

- The flash card market is challenged in the near term with the economic recession in 2009.
- The market will recover in 2010 but the ASPs will show a cyclical downturn in line with flash memory pricing.
- Decline of NAND flash memory pricing over the long term will continue to fuel consumer market for flash cards.
- The consumers need for storage will grow especially with consumer electronic devices that have video capability especially in mobile phones.
- Digital still cameras are drivers in the shorter term but use in video recorders, phones and games machines as well as other applications will spur growth in the future.
- Too many flash memory card formats could be a barrier to consumer adoption as different equipments have incompatible memory slots.

# Hard Disk Drives

**Figure 7.4 – HDD Format Market Share, 2008**
(Percent Of Units)




Source: Future Horizons

The growth for 3.5-inch drive is also slowing in line with lower growth in the desktop PC market, despite being used in new consumer devices markets including some Personal Video Recorders (PVRs).

The 3.5-inch drives have declined in favour of the 2.5-inch product aimed at the higher-growth laptop PC market and also in new markets in global positioning, MP3 players and portable video players.

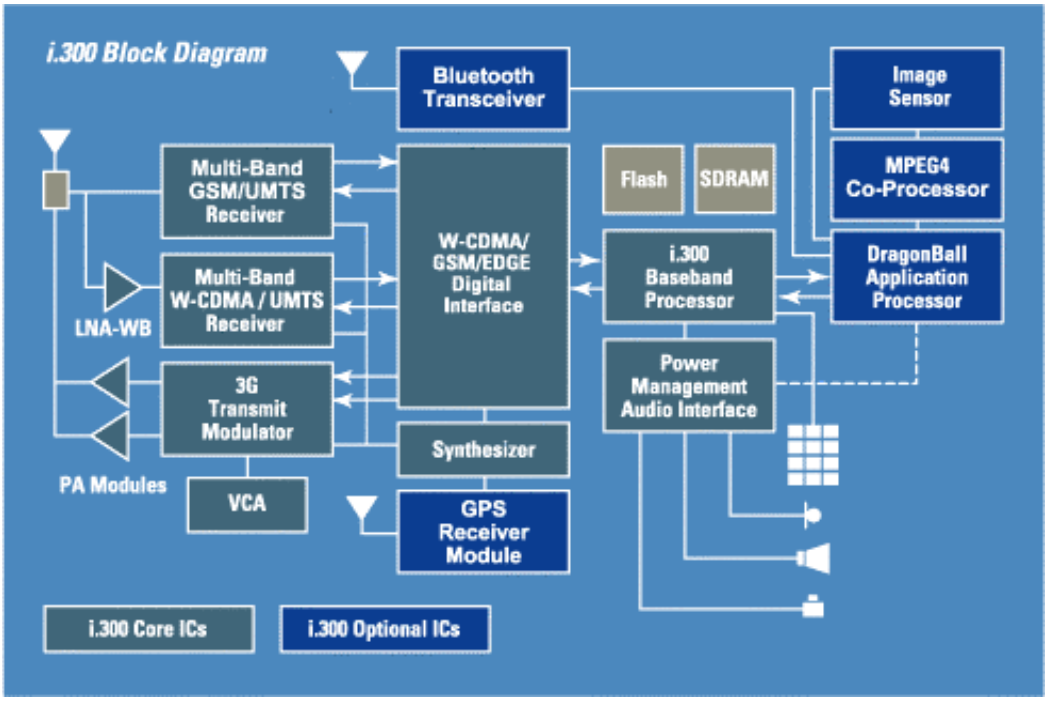
Increased unit sales of the HDD industry are very dependent on smaller format drives used in non-PC consumer markets such as the 1-inch HDD in the Apple iPod and other music players. It is in these consumer markets that the industry sees most competition from solid-state flash memory products. Toshiba, and the lesser known China-based company Magicstor, are developing miniature HDD products aimed at markets such as mobile phones incorporating MP3 players.

The HDD market is in transition as it expands from its base in PCs to portable consumer equipment. There are opportunities for companies that have signal

# Mobile Phones

**Figure 8.2 – Block Diagram Of 3G Mobile Phone Platform**




Source: Freescale Semiconductor/Future Horizons

**'Ultra Low-Cost' Mobile Phones**

In 2004, the GSM Association (GSMA) identified that the greatest barrier to further mobile phone sales to emerging countries such as India, Thailand, Vietnam and some African and Latin American states, was handset price. Their telecommunications economists said that if the handset prices could fall to below US$40 this would open up a new market opportunity. The target price was a Bill of Materials (BOM) below US$25

To achieve this price, mobile phones would be designed to cost by removing unessential features and reducing component prices. Given this target, the RF section target was US$2, baseband US$6, power management US$1 and memory US$2 giving a total semiconductor content of about US$10-12 in very-high volume.

# Mobile Phones

A number of semiconductor suppliers were already working on reducing costs and Infineon, TI, Freescale and a number of other companies produced a single chip or a reduced cost chip set to meet these targets. Motorola spearheaded this development in 2005 with its C11x platform in 2005.

More recently, in a similar exercise, the GSMA announced LG the winner in a '3G for all' low cost mobile phone in 2007. The LG low cost phone is based on a Qualcomm 'single chip' platform solution.

These cost reduction exercises have lowered the price of entry-level phones and it is likely that the 'single chip' phone will feature in one third of all mobile phones by 2012. These will be found in basic and some of the lower end enhanced phone segments.

**Mobile Broadcast TV on the Mobile Phone**

Mobile phones offer an attractive platform for mobile TV as many people carry them and it has a screen for display and an audio output, although the other platforms have their own advantages, particularly larger screen size, Figure 8.3.

**Figure 8.3 – Early DVB-H TV Mobile Phone**


Source: Samsung/LG/Future Horizons

# Bluetooth

Bluetooth is designed to be a Personal Area Network (PAN) where two to eight devices can communicate in what is called a 'Piconet'. Individual Bluetooth controllers forming a Piconet identify and allocate themselves a unique number (address) and listen for and remember the addresses of others within the net. The first device allocates itself the master function and synchronises the other slave Bluetooth devices automatically into a Piconet.

Several Piconets operating on different and unique frequency-hopping algorithms can communicate together in what is called a 'Scatternet'. As all devices in the area will receive Bluetooth packets, each device will have to detect and then reject most of them. For this reason, as the number of Piconets increases in the same area, the data rate for Bluetooth slows.

All this can be carried out with the original generation of Bluetooth. New generations of Bluetooth, such as Version 2.1 + Enhanced Data Rate (EDR), are for 2MHz of bandwidth and larger transmission distances. Future generations expect to have bandwidths of 53-480 MHz but will use UWB as a radio interface.

Bluetooth is the basis of a new 'Personal Area Network' (PAN) international standard IEEE 802.15. Despite this ability most Bluetooth applications require communication only between two pieces of equipment.

**Industry Trends**

Bluetooth chipset unit sales are meeting forecast and industry ambitions by at least doubling every year since production started, although a slowdown is expected as the end applications decrease during the economic downturn in 2009. Bluetooth chipsets are already designed into mobile phones, cameras, camcorders and laptop computers all with potential sales of tens of millions each week.

There is a small overlap in connectivity with other developments such as ZigBee for short distance low data rate transmission with extremely low power and Ultra-

# Bluetooth

**Table 9.1 – Bluetooth Specification Progression**

| Version | Data Rate |
|---|---|
| 1.2 | 1 Mbits/sec |
| 2.0 + EDR | 3 Sec/sec |
| 2.1 + EDR. Low Power/Wibree | 3 Mbits/sec* |
| 3.0 Broadband/WiMedia | 53 - 480 Mbits/sec * |

Source: Future Horizons * Comment: Available 2008

**Table 9.2 – Bluetooth Power Levels**

| Class | Max Permitted Power | Range |
|---|---|---|
| **1** | 100 mW (20 dBm) | 100 metres |
| **2** | 2.5 mW (4 dBm) | 10 metres |
| **3** | 1 mW (0 dBm) | 1 metre |

Source: Future Horizons

A 'Bluetooth profile' is a wireless interface specification between devices that use Bluetooth-based communication.

The profiles describe the behaviour through which Bluetooth-enabled devices communicate with each other. Such a profile, say 'for cordless telephony use', provides standards which manufacturers follow to allow devices to use Bluetooth in the intended manner. At a minimum, each profile specification contains information on the following topics:

- Dependencies on other profiles
- Suggested user interface formats
- Specific parts of the Bluetooth protocol stack

To perform its task, each profile uses particular options and parameters at each layer of the stack.

# ZigBee

Therefore, ZigBee is a technology sitting below the Bluetooth and W-LAN solutions in data handling capacity, but with enough performance to meet the low-power, and low-priced applications that it is aimed at, Table 10.2.

**Table 10.2 – ZigBee & Bluetooth Optimisation**

| ZigBee | Bluetooth |
|---|---|
| Small packets Over Large Network | Large Packets Over Small Network |
| Static Network | Locally Mobile Ad-hoc Networks |
| Infrequently Used Devices | File Transfer |
| - Home Automation<br>- Home Monitoring<br>- Office Automation<br>- Lighting<br>- Remote Control<br>- Toys | - Graphics & Pictures<br>- Hands Free Audio<br>- Mobile Phone & Headsets<br>- PDAs & Laptops<br>- Automotive |

Source: Future Horizons

**Alternatives to Zigbee**

The fabless semiconductor company Zensys has developed another propriety low-cost wireless networking technology. Zensys offers a family of low-cost, low-power, integrated MCU/Transceiver chips embedded with a mesh technology named Z-Wave, as well as a suite of development tools.

Z-Wave is designed for residential and light commercial control and status reading applications such as meter reading, lighting and appliance control, HVAC, access control, intruder and fire detection. Z-Wave is claimed by Zensys to be cheaper than ZigBee.

Z-Wave is well marketed and has support from a Z-Wave Alliance, which is well supported by Zensys. The Z-Wave protocol stack is embedded in the chips, and flash memory is available to the manufacturer / OEM for their application

# Wireless LAN (Wi-Fi)

Some chipsets also support the newly ratified IEEE902.11i security standard using network sign-on to authenticate business users. The newer IEEE902.11n standards and products are discussed later.

**Industry Trends**

W-LAN has had a long history of development and many issues have been resolved with numerous products based on 802.11 standards already on the market. Enterprise and consumer have embraced WiFi technology and have been deploying it to supplement wired Ethernet where mobility is important.

Unit sales were virtually flat between 2000 and 2001, but rose substantially during 2002 and 2003 onwards. During 2003 Intel released its 'Centrino', mobile laptop computer processor and associated Wi-Fi chipset, backed by a US$300 million advertising campaign. This made the capability of Wi-Fi, and Wi-Fi 'Hotspots' familiar to laptop users. It also boosted the sale of laptop PCs from 2003 onwards and in 2008 mobile computers including laptops exceeded fixed computing systems in unit sales. Over 90 percent of laptop computers in 2008 came with embedded WiFi.

To complement these WiFi enabled computing platforms, wireless access points, wireless modem routers and wireless routers, manufactured by companies such as Cisco Linksys, Buffalo, D-Link, Netgear and Symbol Technologies are increasingly commonplace in the enterprise, educational institutions and the home

**Competition Brings Prices Down & Increases Sales**

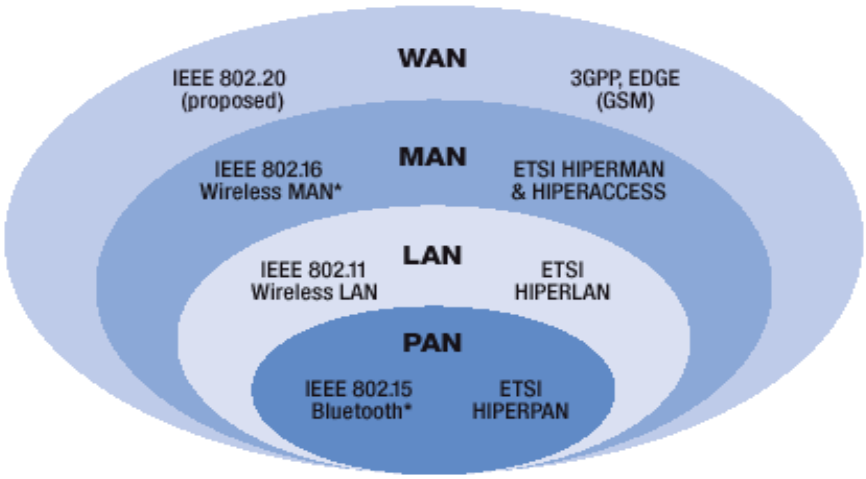
IC suppliers such as the Wireless LAN division of Intersil (now along with Globespan Virata a Conexant company), Agere Systems (now part of LSI Logic), Atheros Communications, Broadcom, Marvell Technology, NXP Semiconductors and Texas Instruments, were early participants in the chip market. They have

# WiMAX

interface. This technology is to be used in 'the last mile' in a Metropolitan Area Network (MAN) and will deliver wireless performance comparable to cable, DSL and T1 wired connections. IEEE 802.16 is one of a hierarchy of standards that has been created by the IEEE for the interoperability of wireless systems, Figure 12.1.

**Figure 12.1 – International Wireless Network Standards**




Source: IEEE/Future Horizons

**WiMAX vs. WiFi**

Competition between Wi-Fi and WiMAX systems will be minimal, with WiMAX targeted at replacing longer-range cable and wired systems instead. WiMAX wireless broadband-beamed radio connections are expected to be transmitted from the top of tall buildings and will have the following benefits over their wired counterparts:

- Lower installation cost
- Faster installation in a given supported area
- Ability to work in hard-to-wire terrain

# WiMAX

Africa have had WiMAX on trial for supplying broadband to country areas. China and India will have WiMAX deployment for connecting small towns and villages that do not have any basic data telecommunication services. Initially services will be targeted at the business user, but as consumer equipment falls in price services will expand to include residential broadband.

Uncertainty and confusion still remains on the suitability of WiMAX as a mobile technology. Mobile radio technologies such as WDMA-HSDPA, CDMA EVDO, IEEE802.20 or improved wireless LANs such as IEEE802.11n may well give broadband access and better mobility, Table 12.1.

**Table 12.1 – Wireless Broadband Technology Comparison**

| | WiMax | CDMA-HSDPA & EV-DO | Wi-Fi |
|---|---|---|---|
| **Data Throughput** | 1Mbits/Per Second | 400-700Kbits/Per Second | 1-5 Mbits/ Per Second |
| **Roll Out** | 2006-2008 | 2005-2007 | 2005-2007 |
| **Spectrum** | Unlicensed & licensed | Licensed | Unlicensed |
| **Voice Use** | Good | Good | Poor |
| **Deployment Cost** | Medium | High | Low |
| **Subscription?** | Yes, Flat Fee | Yes, By Use | Yes, By Use |
| **Availability** | Kilometres from Basestation. Available in Urban & Remoter Areas | Better Availability In Urban Areas. Differs Between Countries. Many Pico Cells Required | Limited Range From Basestation |

Source: Future Horizons

WiMAX is already being considered as one of the broadband data components of 4G mobile radio. The idea is to make an interim solution using 3G plus WiMAX. This may reduce the risk of operators moving to 4G in one expensive step, and Figure 12.4 illustrates this path.

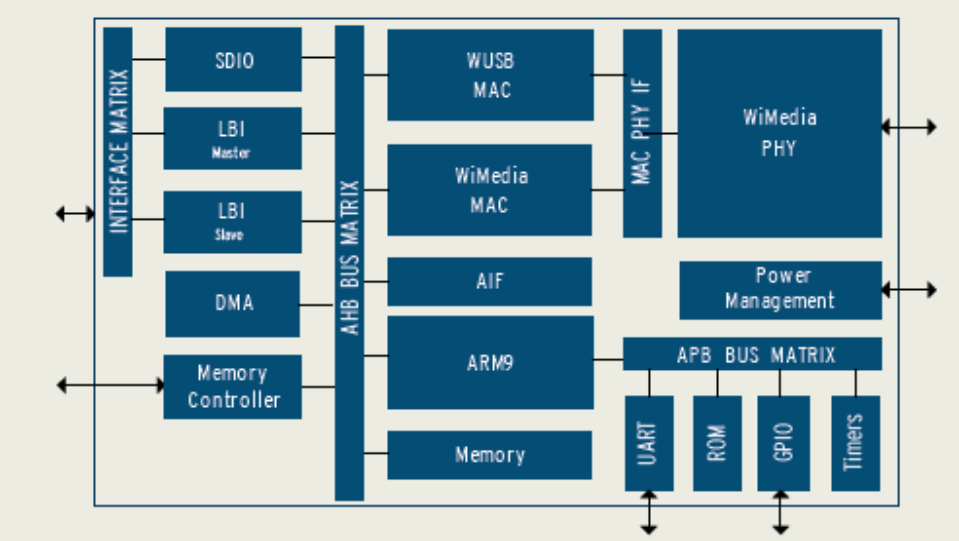
# Ultra-WideBand (UWB)

## Technology Trends

In terms of market timing, 2007 saw OFDM and the direct sequence route commercial UWB semiconductor chipsets hitting the marketplace. One of the most popular is being sampled by the fabless company, Wisair, Figure 13.3.

The chipset consists of an RF transceiver chip and a Media Access Controller (MAC)/Baseband combination chip for the network connection. This gives wire-like video quality and also contains an integrated Detect and Avoid (DAA) mitigation technology, meeting regulatory requirements worldwide - such as in Europe and Japan.

**Figure 13.3 –UWB MAC/Baseband Chip**



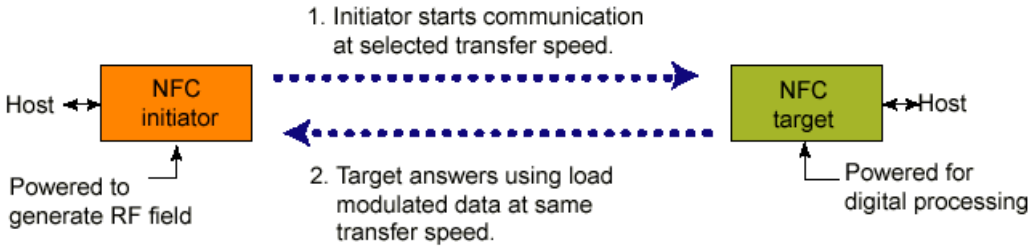

Source: Wisair/Future Horizons

The RF chip is implemented in SiGe-BiCMOS, based on the WiMedia common radio platform, and supports both FFI and TFI schemes with data rates ranging from 53.3Mbps to 480Mbps. The chip incorporates an on-chip RF Band Pass Filter (BPF), a broadband receiver with a wide dynamic range, an ultra-fast

# Near Field Communication (NFC)

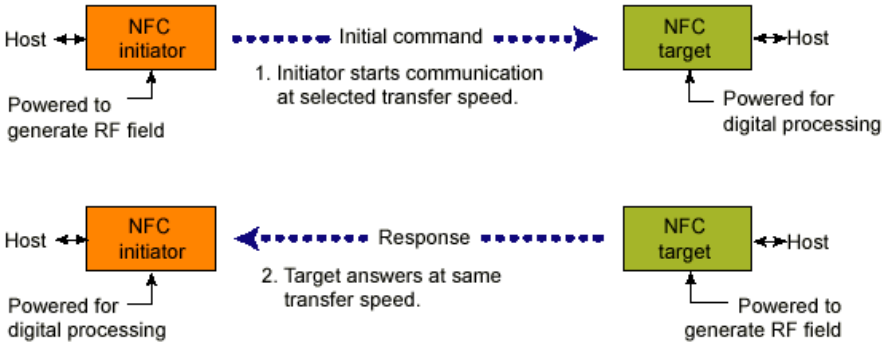
**Figure 14.1 – NFC in Passive Mode**




Source: NXP Semiconductors/Future Horizons

To save power, the target slave device does not have to generate its own field, but sends data back to the master initiator using a 'load-modulation technique' and takes power from the master. In the most common and 'active mode', each device generates its own RF field, operates faster and therefore uses more power. In the active mode, the master and slave can change rolls and either will be able to initiate the communication as illustrated in Figure 14.2.

**Figure 14.2 – NFC in Active Mode**




Source: NXP Semiconductors/Future Horizons

If a battery-powered device runs low on power it can change to act as a target rather than an initiator, saving power but losing some of its functionality.

# Global Positioning By Satellite (GPS)

The Assisted GPS (A-GPS) method is a handset-based location solution, where the handset must have a GPS system. The handset determines its position based on signals from the GPS satellite system and base station signals.

The GPS and assisted GPS system are proving popular choices for operators and this trend is boosting sales of GPS chipsets into mobile phones.

The penetration of GPS functions in mobile phones will help lower the costs for other applications and built-in automotive navigation systems will fall towards the end of the forecast period. Car navigation systems, as additional options, are popular in Japan, and their use is also growing in Europe and the USA, particularly in rental vehicles.

**Suppliers**

Examples of open-market stand-alone equipment suppliers are Alpine, Blaupunkt, DeLorme, Furuno, Fortuna, Garmin, Icom, Lowrence, Magellan (now part of Thales), Mio Technology, OnStar, Sony, Tom Tom, Trimble, Unitraq, and Voyager, with GPS semiconductor components coming from Ashvattha Semiconductors, Broadcom, Cambridge Silicon Radio (CSR), Conexant Systems, Freescale Semiconductors, IBM Microelectronics, Infineon Technologies, Nemerix, Sirf Technology, SiGe, Sony Semiconductor, SnapTrack (Now Qualcomm), STMicroelectronics, U-Nav, and Valence Semiconductor.

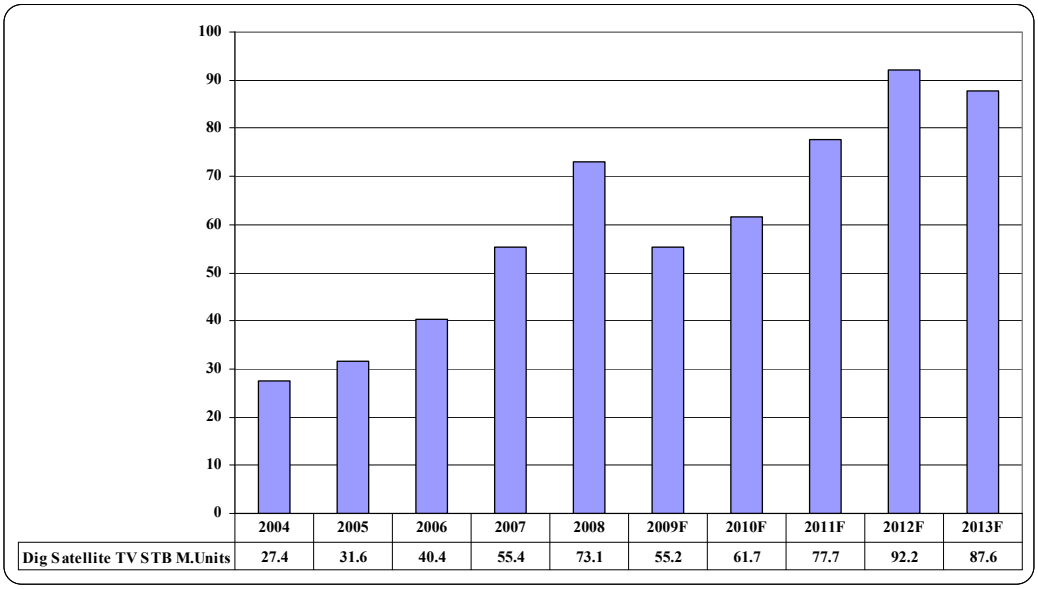
**Technology Trends**

Global positioning is a complex and precision engineering exercise, both in terms of hardware and software design, and in terms of the use of data. Companies such as Garmin, Magellan and Trimble have been supplying handheld and vehicle mounted GPS ‘stand-alone’ receivers for use by explorers, surveyors and sailors since the 1980’s and prices range from US$25,000 to US$100,000 dependent on the application and accuracy required.

# Digital TV Set-Top Boxes (STB) & PVR

**Figure 16.3 – Worldwide Digital Satellite TV STB Production, 2004-2013**
(Millions of Units)




| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009F | 2010F | 2011F | 2012F | 2013F |
|---|---|---|---|---|---|---|---|---|---|---|
| Dig Satellite TV STB M.Units | 27.4 | 31.6 | 40.4 | 55.4 | 73.1 | 55.2 | 61.7 | 77.7 | 92.2 | 87.6 |

Source: Future Horizons

**The Digital Terrestrial Set-Top-Box**

There was a spectacular failure of ITV Digital in the UK in 2002 - which resulted in the UK being behind their target to switch-off analogue TV in 2010 - and a similar failure of Quiero in Spain were symptomatic other terrestrial launch delays.

In the UK, however, a consortium of competitors rescued the digital TV business. Content and operating companies such as the BBC and BSkyB joined with wireless infrastructure company, Crown Castle, and formed a new free-to-air service called 'Freeview'. After heavy promotion by the BBC, UK consumers are starting to use the system and can now view up to 30 channels, including the standard five channels available on analogue terrestrial TV, plus 30 free digital radio stations. Other regions, including Italy and Germany are starting to follow the UK trend for digital.

# Integrated Digital TVs

## Industry Trends

The flat-panel iDTV has an advantage as it is a reliable piece of hardware and is welcomed in most homes because of its smaller size compared with its CRT equivalent. Now that HDTV capability is being built-in, TV manufacturers have innovations panned to introduce Internet content onto high-end TV screens.

Sharp has rolled out AquosNet, a web-based push-service that will send weather, stock prices, TV programmes and other information to a corner of a Internet capable TV screen. Sharp intends using HomePlug AV Powerline home network technology, Ethernet or a wireless LAN connection to get data from a proprietary web portal. It will not give full Internet access and will not use a keyboard.

LG has a deal with NetFlix to supply an Internet video player so customers can download a film. H-P is already testing a media-smart TV and a Microsoft developed home server, using a wireless connection to the Internet. We should see some announcements from at least one of these three TV suppliers during the next few years on further developments.

### Digital Broadcast Systems

The 3 different regional terrestrial analogue TV systems, PAL, NTSC and SECAM all use 6 MHz of bandwidth and differ in detail with each other but they can all suffer interference such as ghosting caused by reflections and atmospherics, which further degrade the received signal.

In the case of digitally broadcast TV, whether the signal is broadcast by digital terrestrial means through the air, digital cable, digital satellite, or transmission down a telephone line using Digital Subscriber Line (DSL) technology, these techniques suffer less from picture deterioration by interference if the signal is strong enough.

Digital TV broadcasters can transmit the same picture detail and quality into a smaller bandwidth by using digital compression techniques. Digital TV normally

# DAB & Other Digital Broadcast Radio

## 18 DAB & Other Digital Broadcast Radio

**Description**

Digital radio covers a number of digital broadcasting families of technologies such as:

- Eureka 147 standard - branded as Digital Audio Broadcasting (DAB, DAB+)
- FM In-Band on-Channel (FM-IBOC) - branded as HD Radio and FMeXtra
- AM In-Band on-Channel (AM-IBOC) - branded as Digital Radio Mondiale (DRM)
- Satellite Radio - branded as Sirius or XM Radio (In the USA and Canada)

  - Branded as WorldSpace (elsewhere)

- **DAB (or Eureka-147)**

  DAB was developed as a research project for the European Union (Eureka project EU147), and started in 1987. DAB was the first standard based on Orthogonal Frequency Division Multiplexing (OFDM) modulation technique, which has now become one of the most popular transmission schemes for modern wideband digital communication systems.

  First trial broadcasts were made in the United Kingdom during 1990 and public demonstrations in 1993. The protocol specification was then finalised in 1993 and adopted by the ITU-R. Commercial DAB receivers were first to be sold in 1999 and there are now over 1000 DAB broadcasting stations.

# Video Game Consoles & Handhelds

Some names, such as Atari and 3DO are no longer seen in the video games console market, leaving the market to the big players that can handle massive marketing and software development needed for global consumer products. 3DO and another big name, Sega, which had over 50 percent of the market several years ago, made the transition from being a console manufacturer to supplying technology and software only. Sega now has partnership deals with TV STB manufacturers, such as Pace in England, to develop game features on the box and via the Internet.

The video games console manufacturers not only have to compete among themselves but also with other games platforms such as PCs, STBs, Internet TVs and data-orientated mobile phones. *These other game platforms are not included in this section.*

**The Future of Video Game Consoles**

During the final quarter of 2006, the first blows of the new video game console market war were made. Under various levels of fanfare the PlayStation3 and the Nintendo Wii were launched to eager consumers. Immediate difficulties arose when demand outstripped supply, in a similar way to the launch of the original Xbox and the Xbox360 later. The same delivery problems arose in 2007 as both the Nintendo Wii and the Sony PS3 were in short supply during some periods during the year.

In the battle between the original Xbox and the PlayStation 2 the contenders spent over US$2 billion on marketing the products for the first couple of years and on the battle between the Xbox360, PlayStation3 and WII. The battle for supremacy of the games markets has raged for decades and will continue into the future.

The PS3 is the most powerful system and its cell processor cost millions to develop. Scarcity of consoles in the early launch period will cause pressures on Sony's cash flow, but the cost will be worth it to establish the centrepiece of

# Home DVD Players

Players using Blu-ray technology are strongly supported by Sony and Philips, and HD-DVD technology were strongly supported by Toshiba and NEC. Both types became available in Japan during 2005 and, at the time, were larger, heavier and 10 times the price of standard machines. Companies began rolling out sales to other countries during 2006 and both were available on the market in 2007.

However, in 2008 the format war was won by Blu-ray following the decision by a number of movie companies to move their backing from HD-DVD to Blu-ray. Sony's heavy promotion of the standard in the PS3 games console and lobbying of the movie companies with promises of better content protection were elements in the final decision. Manufacture of HD-DVD players has now ceased

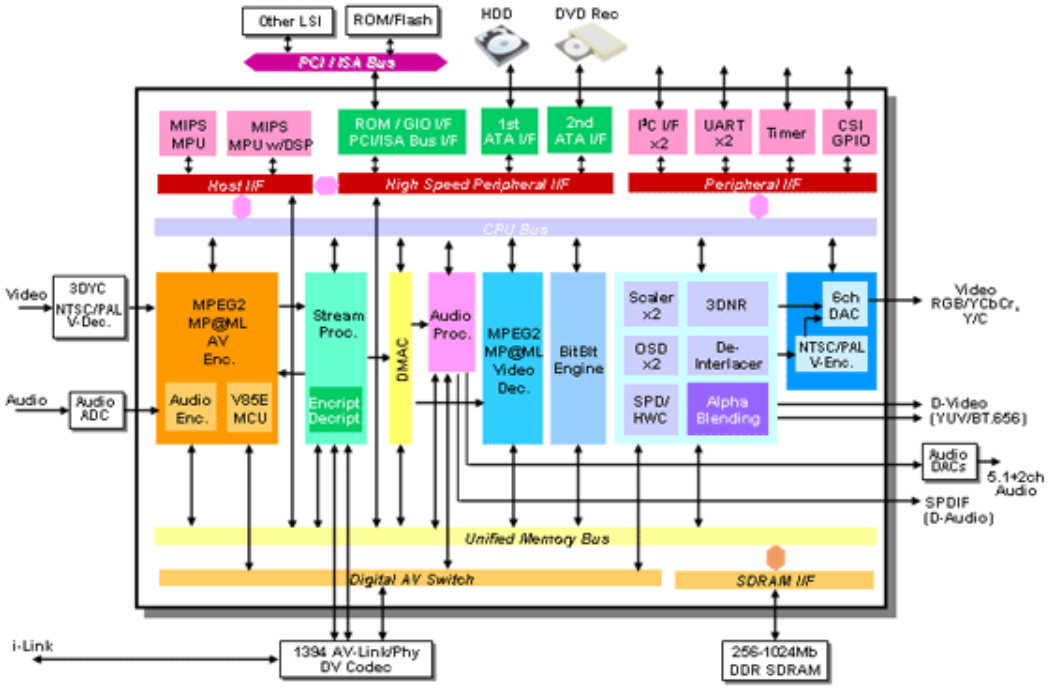
Player demand in the future will depend on lowering prices and availability of compatible high definition flat-panel TV sets and this started to happen during 2008 It is noticeable that anything labelled 'high definition' sells well in the US. The uptake in Europe and Japan has been a little slower as most consumers in these countries use smaller screens and picture defects on standard DVD are less noticeable. Despite this, LCD TVs with HD capability now outsell CRT TVs despite a current lack of HD TV service to most customers. The other important driver is the availability of high definition films to purchase - new Blu-ray film titles are appearing but are still in the minority on shop shelves. A typical example of a Blue-ray player is given in Figure 20.5. At the moment it is larger, heavier and more expensive than the standard DVD player. However, prices of the equipment and semiconductors will get lower towards the end of the forecast period.

# Home DVD Recorders

The chip has two advanced technology attachment (ATA) ports, which are employed for up to 4 HDD/DVD drive connections. This dual-ATA feature, with the above-mentioned stream processor capability, supports complicated functions such as time-shifting playback with HDD while programming on a DVD drive, Figure 21.5.

**Figure 21.5 – Typical Advanced Home DVD Recorder Processor**




Source: NEC Electronics/Future Horizons

Traditional suppliers to the DVD recorder semiconductor market are from the companies listed in the DVD player chapter, such as Cirrus Logic, ESS Technology, LSI Logic, Matsushita/Panasonic, National Semiconductors, NEC, Philips Semiconductors, STMicroelectronics and Zoran. These companies are

# Digital Still Cameras

- The first 'churn' of digital cameras has now been reached and the projected market assumes that customers will replace their cameras every four years.
- The impact of 'camera mobile phones' has only just been felt. Phone cameras are already taking the low end of the market and the mobile phone operators are increasing the quantity of phone cameras and the quality of images. So far this has not appeared to impact on DSC and may have encouraged more sales of standalone digital cameras.
- The move of cameras from CCD to cheaper but high quality CMOS image sensors.
- The impact of the non-Japanese Far East as a new market, particularly the impact of the newly industrialised China.
- The creation of sub US$50 sector and disposable digital cameras.

Competition has meant that entry-level cameras, with the minimum of resolution and without features such as LCD displays, are selling for as little as US$25 dollars and are sometimes bundled as 'free' with PCs and printers. The established brand names are increasing the resolution and features, such as larger built-in memory size, improved 'shutter' speeds and shake free images in their best selling lines not only to withstand competition from entry-level and phone cameras but also to maintain average selling price at US$60-150 for 4 and 5 Megapixel products.

Digital camera manufacturers had very good years in 2003-2007 but the market will have falling growth rates in the future and this is made worse by the 2009 recession.

The commoditisation of digital still camera sales is putting much pressure on component suppliers, particularly in the image sensor market where a shakeout of the 30-40 suppliers is beginning to happen. National Semiconductor sold its

# Digital Camcorders

**Digital Camcorder Semiconductor Technology**

Digital camcorders contain a CCD imager incorporating an ADC, followed by a propriety image processor for image pre-processing improvement tasks such as image conditioning using interpolation and extrapolation.

Because uncompressed image data requires considerable storage capacity and transmission bandwidth, the image data is compressed using propriety, or more commonly MPEG, encryption for recording and decryption for playback.

The pre-processing, image conditioning, DSP, MPEG processing and system control microprocessor sections are often incorporated in two or three SoC ICs, or even a single large SoC dependent on the digital camcorder manufacturer.

To reduce the jittery video by shaky operator hands image stabilisation is important and there are two types. The first is mechanical and is where the lens mechanism moves to compensate for external movement and the second compensates electronically, and is usually cheaper. To do electronic stabilisation the image is captured, but 'floats' on the CCD and then the signal processing interprets the results removing the jitter.

Other functions such as communications (Bluetooth, FireWire IEEE 1394, Wi-Fi, USB) and memory are, at present, kept separate for simplifying product development, Figure 23.5.

After processing, data is sent to the storage section. Data can also be sent to a PC via USB, FireWire (IEEE 1394) and, more recently, wireless LAN normally for video playback. Video information is also sent to the integrated LCD screen for image viewing.

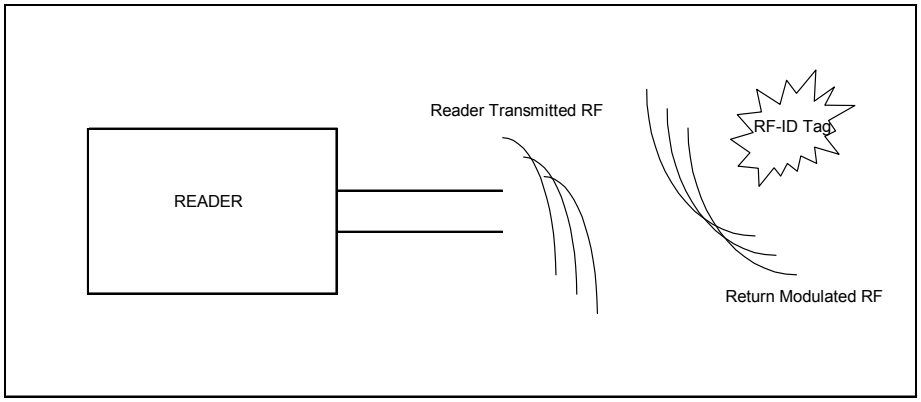
# RF-ID Tags

from the tag by the reader can be sent to a host computer for processing, or stored in a portable reader and uploaded for processing later.

Two types of RF-ID tags are used:

- **'Passive'** tags are for simple applications and at present can cost less than 20 cents and operate without a battery. The reader sends radio waves to the tag's antenna, which is tuned to the right frequency, and creates an AC voltage that is rectified and stored on a capacitor. This allows the tag to draw energy and transmit the information on the tag, using Amplitude-Shift Keying (ASK), and Frequency-Shift Keying (FSK), or Phase-Shift Keying (PSK), modulation for a distance up to 1 metre.
- **'Active'** tags are for more complex, longer distance applications and can cost as much as US$20. These come with a battery, which is used to power the tag's IC and transmit the information back to the receiver. Active tags can be both programmed to have fixed (read only) or variable (read/write) data.

**Figure 24.2 – The RF-ID Tag Electronic System**




Source: Future Horizons

# Biometrics & Fingerprint Scanners

**Biometrics**

Biometrics, is the use of a person's unique physical traits for authentication, and can be used recognising an individual. Analysing some unique personal traits such as fingerprints, hand geometry, voice, facial characteristics and signature or iris features can be used to identify an individual, Table 25.1.

**Table 25.1 – Exploitation Of Biometric Features**

| Biometric | Feature |
|---|---|
| Iris | The unique structure of the coloured ring of textured tissue that surrounds the pupil of the eye |
| Retina | The unique pattern in the layer of blood vessels in the back of the eye |
| Face | A collection of facial images are collected by a video camera |
| Fingerprint | Minutiae of the fingerprints are captured using electronic, optical, tactile or thermal techniques |
| Hand Geometry | An image of the hand allows measurement of the shape of the hand and the size of fingers and knuckles |
| Signature | The way we sign rather than the finished signature |
| Voice | The sound of the voice rather than the words spoken |

Source: Future Horizons

Reading fingerprints is by far the most popular method of biometric authentication because it is easy to use, and password and PIN administration may not be necessary. Fingerprint sensors are shown in Figure 25.3.

# Robotics

Typical of a specialist niche is the 'CyberKnife' robotic radio surgery system, which is a commercially available radiotherapy system, designed to treat tumours anywhere in the body with sub-millimetre accuracy.

Using image guidance technology and computer controlled robotics, the CyberKnife System is designed to continuously track, detect and correct, for tumour and patient movement throughout the treatment. Unlike human surgeons this does not demand head or body frames to stabilise patient movement, Figure 26.2.

**Figure 26.2 – Radio Surgery Robot**

Source: Accuray/Future Horizons

**Technical Competence to Market Innovation**

The first part of the current decade was the first step towards the robotic revolution, and in the spring 2003, 95 robots were demonstrated at the Robodex show. Toshiba is proposing a new robotics open architecture – a useful step

# Automotive

**In Car Communication And Control Buses**

More advanced electronics will lead to more distributed systems. These can make design, manufacture, maintenance, customisation and upgrading easier. Present-day wiring is unpopular with car designers for two reasons.

Firstly, a chain is only as strong as its weakest link and the existing wire harness and connectors are a common failure hazard. Secondly, wire harnesses require holes to be cut to allow their access, weakening the car frame.

Harnesses are also unpopular with manufacturing plants, as they are bulky, expensive, complicated and do not contribute with ease to mass production. For this reason, smart sensors are beginning to be used and these communicate via serial buses.

The serial bus system, which is just being adopted in the automotive industry, is named 'Controller Area Network (CAN)', and there will be at least 2 in each car, Figure 27.4.

The CAN 1Mbits-per-second high-speed 'power-train' network bus allows communication between the engine control unit and a powerful 32-bit microcontroller capable of managing the system and simultaneously implementing a Discrete Fourier Transform on misfire detection. On the same chip, this microcontroller will have a large variety of peripherals, such as timers, multiple ADCs, and network interfaces.

A slower speed 'chassis' bus is used for activities such as security and lighting, and will be less demanding on the microcontroller and the bus speed. The advantage of using CAN in automotive applications is that it has a fault-tolerant protocol, and important high-priority signals are transmitted in a known and guaranteed time.

the induction motor and can increase torque production through electromagnetic gearing.

**Building Management**

An example of a modern environmentally controlled building is the Heelis Building owned by The National Trust in Swindon, England. The building has a north/south orientation to the roof pitches. The north facing pitches allow the maximum possible amount of daylight to enter the building without causing it to overheat. The south facing pitches are covered in 1,554 photovoltaic solar panels, which provide around 40 percent of the buildings electricity needs. The electricity generated is used in the building and any excess is sold back to the electricity grid.

A lighting control system adjusts the level of artificial light in response to external conditions and movement sensors ensure that lights are turned off in unoccupied areas. Roller blinds internally and brick fins externally prevent any excess glare. Some windows are controlled automatically and others can be opened manually. Roof vents are controlled by special sensors and open into the distinctive 'snouts' on top of the building and act as umbrellas against the rain and as chimneys to ensure the circulation of fresh air.

During the winter, much of the heat is provided by incoming fresh air warmed by the extracted air, which has been heated by people and the electronic equipment associated with a modern office, Figure 28.5.

# Digital Media Players

will still support sales on iTunes of 128Kbits/sec encoded (and DRM protected) material at US$0.99 per track. Apple is not free to offer any other copyrighted material 'DRM free' unless it obtains the agreement of the record company

**Flash Based Digital Audio Players**

Flash-based models are now dominating the DMP market because during 2005 and 2007 flash memory reduced in price enough to allow the useful 1GByte and 2GByte models to get within an acceptable price range of US15 to US$50. These models will hold a 'reasonable' amount of music for the average user, plus some family photos and have sufficient storage for optional audio books downloaded from suppliers such as www.audible.com and www.talkingbooks.co.uk.

DMPs with larger memories are also enabling people to playback free radio podcasts from sources like www.bbc.co.uk or others listed on directories such as www.podcast.net. Many DMPs, including the Apple iPod, are becoming more photo and video aDMPted on every model change. This means that up-market DMPs are gradually encroaching on the Digital Video Player (DVP) market. These devices are not included as part of this category.

DMPs are the type of consumer item that have a global 'one per person' potential among the 10-40 year olds and sales are picking up well in the newly industrialised nations. Many famous brand names in the electronics industry are marketing DMPs, including SanDisk and Samsung, which also are flash memory suppliers. Table 29.11 shows a list of popular suppliers. Due to high demand in the Far East, there are over 50 suppliers in the region with a high concentration in China.

DMP growth took a number of years to gain momentum in line with the growth of acceptance of downloading music tracks from the Internet and the falling price of disk drives and flash memory. Sales of players really took off in 2004 and this

FutureHorizons
The Global Semiconductor Industry Analysts

**Research Reports**

**Consulting Projects**

**Workshops & Forums**

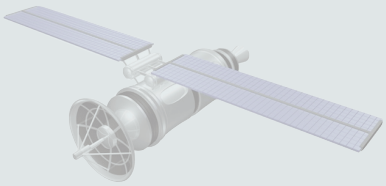
**Design Services**

**Due Dilligence**

## 25th Year Of Service Founded 1989

## 5th Decade Of Semiconductor Experience

## Our Experience Starts With The First Commercial IC



Established in April 1989, Future Horizons provides market research and business support services for use in opportunity analysis, business planning and new market development. Its industry information seminars and forums are widely considered to be the best of their kind. Emphasis is placed on the world-wide semiconductor and electronics industry and associated markets. Emphasis is placed on the worldwide microelectronics and electronics industry, and European market environment.

Malcolm Penn is the founder and CEO of Future Horizons, with over 45 years experience in the electronics and semiconductor industry. He has worked extensively throughout Europe as well as in the United States, the former USSR, Japan and Korea, and was an early pioneer of pan-European research and product development collaboration in the 1970s during his tenure with ITT Europe. His industrial experience has involved him with all aspects of the management, manufacturing, marketing and use of electronic components, particularly semiconductor devices.

Future Horizons offers a high-quality, cost-effective, flexible alternative to expensive subscription-style, market research. Our experience commenced with the industry in 1962, from the first commercial IC to SOC integration. For all of your semiconductor business development needs …

***Let Future Horizons Save YOU Time & Money***


US Representative:
Lane Mason
Senior Industry Analyst
Palo Alto, California, USA
Tel: + 1 650 248 6178
lmason@futurehorizons.com

Russian Affiliate:
ELINT
6th Floor, 40 Bldg, 1, 3y Proezd Maryinoy Roshchi
127018 Moscow, Russia
Tel: +7 459 228 0766
Fax: + 7 495 787 3869
elintsp@mail.ru

Far East Representative:
Masanori Sugane
Director of Japan Office
Itabashi-ku, Tokyo, Japan
Tel: + 81 90 3141 7966
sugane@futurehorizons.com

Israel Affiliate:
Amir Ben Artzi Content & Media
40 Derech Hayam St.
Havatzelet Hasharon, 42937 Israel
Tel: + 972 73 7367966
Fax: + 972 9 8665799
amir@amircm.com

Indian Affiliate:
Pradeep Chakraborty PC Mediaworks
Tel: +91 99451 27632
pradeepchakra@gmail.com

European Affiliate:
GMC Suisse
Ch. de la Dauphine 20
CH-1291 Commugny
Switzerland
Tel: + 41 22 349 0939
wladek@grabinski.ch

Future Horizons Ltd, • 44 Bethel Road • Sevenoaks • Kent TN13 3UE • England
Tel: +44 1732 740440 • Fax: +44 1732 740442
e-mail: mail@futurehorizons.com • www.futurehorizons.com