

Memory Products

Rapid and innovative in the memory business

With a continually growing product portfolio, we keep abreast of the latest electronics market trends. Infineon's DRAMs feature amongst the lowest power use and the highest speeds in the industry. With the scheduled introduction of 90-nanometer process technology we are securing our competitiveness.

The memory business – cyclical and fast-moving

Workstations, desktops, and notebook PCs account for between 50 and 60 percent of the DRAM memory chips manufactured today. Servers and network infrastructure take a further 20 or 30 percent. Consumer electronics and telecommunications are smaller market segments, each using under 10 percent share of DRAM memory chips. Telecommunications, however, is the fastest-growing segment, driven by high volume requirements and memory needs of mobile phones.

Market researchers expect DRAM demand in bits to rise about 50 percent annually over the next few years. Semiconductor manufacturers will meet this growth in demand mainly by introducing more and more advanced production technologies, supplemented by investment in new manufacturing facilities. The memory products sector is thus characterized by high investment, while the growth of supply and demand is subject to strong fluctuations. This leads to enormous price volatility, and to cyclical shifts in revenues and earnings. PC manufacturers configure their models according to memory prices; when memory is inexpensive, PCs are manufactured with high memory capacity, and vice versa.

The latest game console generation is currently the focus of DRAM manufacturers' interest. To display their top-quality graphics, game consoles require the industry's fastest memory products that are developed and manufactured by only a few companies, such as Infineon. The business with game consoles, compared to that with PCs, requires close relationships to the memory suppliers and enjoys relatively stable demand and pricing.

The ever-growing diversity of mobile gadgets such as digital cameras, smart phones, and PDAs increasingly requires memory components with low energy use. Energy-saving memory is, however, also necessary for high-capacity servers and notebook graphics systems, as a means of keeping heat generation to a minimum when the devices

are used at full power. Our DRAM products are outstandingly energy-efficient.

One of the most interesting developments in the semiconductor market has been the rapid growth of the NAND flash memory business. This type of memory can be found in removable storage media such as the MultiMediaCard, SD Card, Memory Stick, and USB stick, which provide the high memory capacity required in digital cameras and MP3 players. Infineon also provides flash cards of various formats, although currently with relatively low memory densities. We aim to accelerate our innovation in this rapidly growing business in the coming years in order to join the market leaders.

Reacting flexibly to market conditions

Innovation and flexibility are key to profitable growth when competing in the memory products market. Infineon is able to use its state-of-the-art production technologies to reduce its memory production costs considerably each year. In June 2005, the Company began the transition to its → **90-nanometer production process** for DRAMs. We have also expanded production capacity of our 300-millimeter technology; here Infineon is operating at the cutting edge with memory products that can be manufactured more economically. In this way, we will strive to ensure that in the future we will continue to increase our productivity in the manufacture of memory components by some 30 percent annually. Furthermore, in February 2005, we introduced a DRAM prototype based on our future → **70-nanometer production process** technology.

We have considerably improved our competitive position in the DRAM market since the mid-1990s. With a current share of 14 percent, we are one of the top four in the worldwide DRAM market. To reach our goal of continual profitable growth, we are aiming to reduce costs further by increasing productivity, and are directing our product range into market segments that show higher prices and

less price fluctuation. We are convinced that, in this way, we will be able to improve the profitability of our memory segment.

In recent years, we have gained a reputation as an innovative supplier of memory products for servers (→ **FB-DIMM**). Up to 30 percent of our memory chips are sold in this computer segment, where we are able to achieve higher and more stable profit margins than with conventional PC modules. Infineon is also a technological leader in graphics memory or → **Graphics RAMs**, which are designed for the highest reading and writing speeds. The early development of the next generation of memory products (→ **DDR3**), and a leading position in the introduction of new memory modules (→ **Micro-DIMM**) constitute two further steps along the path to profitable growth.

We have launched Aeneon as a secondary brand to meet the requirements of a number of PC and notebook manufacturers, particularly in the high-growth PC markets in emerging economies. Working with our distribution partners, we are thus increasingly addressing a highly fragmented customer segment.

Expansion of development and production

We began the volume production of memory chips at our 300-millimeter facility in Richmond, Virginia, in September 2005. We will continue to rely on cooperative agreements in the future to expand our production capacity, and to develop new products and processes. In this way, risks and costs can be shared, while projects are given a broader resource and financial base. Our production agreements with Winbond in Taiwan and SMIC in China are both running according to plan. SMIC's new 300-millimeter facility in Beijing commenced operations using our 110-nanometer technology. SMIC is also producing products for us at a 200-millimeter facility near Shanghai. Together with Nanya, we are running the manufacturing joint venture, Inotera Memories, from which Infineon receives half of all manufactured goods. We transferred our 90-nanometer technology to Inotera at the end of 2005. We also expanded our longstanding development collaboration with Nanya: in addition to our joint development of 90-nanometer technology, and combined activities cur-

rently underway on 70-nanometer technology, we will now also work together on 60-nanometer technology.

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Infineon innovations

90-nanometer production process

This production process enables smaller structural sizes. The chip surface is roughly 30 percent smaller than that produced in the current 110-nanometer standard. Infineon is the second DRAM manufacturer to introduce this production technology. Smaller chips mean more chips per wafer and lower production costs. More than 1,000 512-megabit chips can now be sited on a 300-millimeter wafer using 90-nanometer technology.

70-nanometer production process

The first prototypes were introduced at the beginning of the 2005 financial year. Volume production is to start in calendar year 2006.

FB-DIMM

Latest servers will be equipped with this memory module format (Fully Buffered Dual-Inline Memory Module) by the end of 2005. The required AMB (Advanced Memory Buffer) is a complex logic chip that combines signals and transmits them via data lines to the processor at high speeds. Infineon is the only manufacturer that is able to produce both the memory modules and AMB. The first samples of these modules were shown publicly in spring 2005.

Graphics RAM

This memory product, featuring a clock rate of up to 800 megahertz, was designed for the high-end performance segment. The king of DRAM memories is used as working memory by graphics cards and game consoles. Manufacturers of 3D graphics cards and game consoles make the highest demands. Today's computer games, with their photographic realism, smooth image flow, and high refresh rates, require the calculation of several million polygons per second. Graphics memory access therefore needs to run without a hitch.

DDR3

The first memory modules based on the next standard memory generation were shown in 2005. Their market launch is expected in 2007. By 2012, DDR3 will be the mass market product for PCs, notebooks, workstations, and servers.

Micro-DIMM

Small memory module format for sub-notebooks.