

INTEL, RAMBUS DRAW LINES IN SILICON

DRAM Intellectual-Property Issues Spur Cooperation and Contention

By Peter N. Glaskowsky {2/7/00-04}

The technical landscape of the DRAM business is changing—again. While Rambus's Direct RDRAM once seemed destined to dominate PC main-memory applications for years to come, its future now seems limited in scope and time. Faster variants of synchronous DRAM

(SDRAM) with higher clock frequencies and improved double-data-rate (DDR) interfaces, once viewed as stopgap solutions, now have long-term futures—especially in niche applications such as servers. By the time these solutions reach the end of their useful life, a new advanced DRAM standard may be ready to take their place.

Intel—though still the industry's staunchest supporter of Direct RDRAM for near-term applications—and five major DRAM manufacturers have announced a cooperative advanced DRAM technology (ADT) effort to develop advanced DRAM technology to be used in personal computers and other systems. The new standard could be shipped in high-end PCs as early as 2003, though we feel mainstream adoption is unlikely before 2005. Improved SDRAM derivatives will be hard-pressed to last this long, but resistance to Direct RDRAM is strong among DRAM makers and OEMs.

Rambus, which is not part of the ADT effort, filed a lawsuit just one day later that could have a far-reaching impact on these plans—indeed, on all makers and users of synchronous memory. The lawsuit names Hitachi but sends a clear message to the whole DRAM industry.

Rambus claims that four of its patents cover technology essential to the design of PC100 and PC133 SDRAM, plus DDR SDRAM, SGRAM, dual-in-line memory modules (DIMMs), and SDRAM controllers such as those in Hitachi's SH-2 through SH-5 microprocessors. We anticipate that Rambus will soon file a request with the International Trade

Commission (ITC) to stop the importation of allegedly infringing Hitachi products, a move that would certainly raise the stakes. Rambus is in negotiations with other makers of SDRAM and related products, and is clearly willing to protect these patents through litigation if acceptable licensing terms cannot be reached.

Rambus claims its patents (U.S. Patent Nos. 5,915,105; 5,953,263; 5,954,804; and 5,995,443) stem from an original April 1990 filing. The patents cover a variety of improvements to the basic concept of synchronous memory interfaces (a concept that was already well established by 1990). These improvements appear to include double-data-rate signaling, programmable latency, delay-locked-loop clock synchronization, synchronous multiplexed outputs, multiple-bank designs, and other features found on modern SDRAMs.

Partners Plan to Replace RDRAM

The ADT effort, which includes Hyundai, Infineon, Micron, NEC, and Samsung, hopes to develop a successor to Direct RDRAM. Four of these DRAM vendors (except NEC) are among today's strongest proponents of DDR SDRAM, while NEC has its own virtual channel SDRAM technology to offer (see MPR 10/26/98-msb, "Virtual Channel SDRAM Supported, Attacked"). Hitachi is also involved in the ADT partnership, albeit indirectly, through its joint venture with NEC.

Intel has frequently defended its efforts to push the PC industry toward RDRAM by citing Rambus's undeniable throughput and pin-efficiency advantages, as well as the

long-term viability of the basic concepts behind RDRAM such as its source-synchronous clocking scheme. These advantages, however, are offset by the higher manufacturing and testing costs of RDRAM, and further compounded by small royalties that must be paid to Rambus.

At least in the current generation of RDRAM-based systems (those using Intel's 820 and 840 chip sets; see MPR 10/25/99-07, "Intel 840 Brings RDRAM to Workstations"), RDRAM provides more bandwidth than can be used. These systems offer only a small performance advantage over older models based on Intel's 440BX chip set with PC100 SDRAM. Though almost all OEMs now offer systems based on the 820 and 840, BX-based boxes remain more popular; a few OEMs are using VIA's new Apollo Pro133a to gain the (minor) benefits of PC133 memory.

The ADT partners stress the need for "cost-effective" DRAM technology, which we interpret as a poke at Rambus. The ADT development effort seems likely to follow the form of previous industry collaborations such as PCI and USB, which feature patent pools that protect participants against

intellectual-property litigation from fellow participants. Rambus is not (as yet) involved in the ADT partnership, and if an ADT patent pool is established, we believe it unlikely that Rambus would join.

No matter what technology directions the ADT effort takes, it is unlikely to avoid stepping on one or more Rambus patents. Rambus says it has 80 issued patents worldwide, with about 100 more patents pending. Even if the ADT partners succeed in developing next-generation memory technology without help from Rambus, they may not be able to avoid paying royalties to Rambus because of these patents.

Rambus's patents have never been tested in court, but challenges now seem inevitable. There is a great deal of prior art in the DRAM industry that may narrow the interpretation of Rambus's claims, but what remains may cover a great deal of ground. Rambus has made substantial investments in research and development over the years. If the facts and the courts support Rambus, the return on these investments could be huge. ♦

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