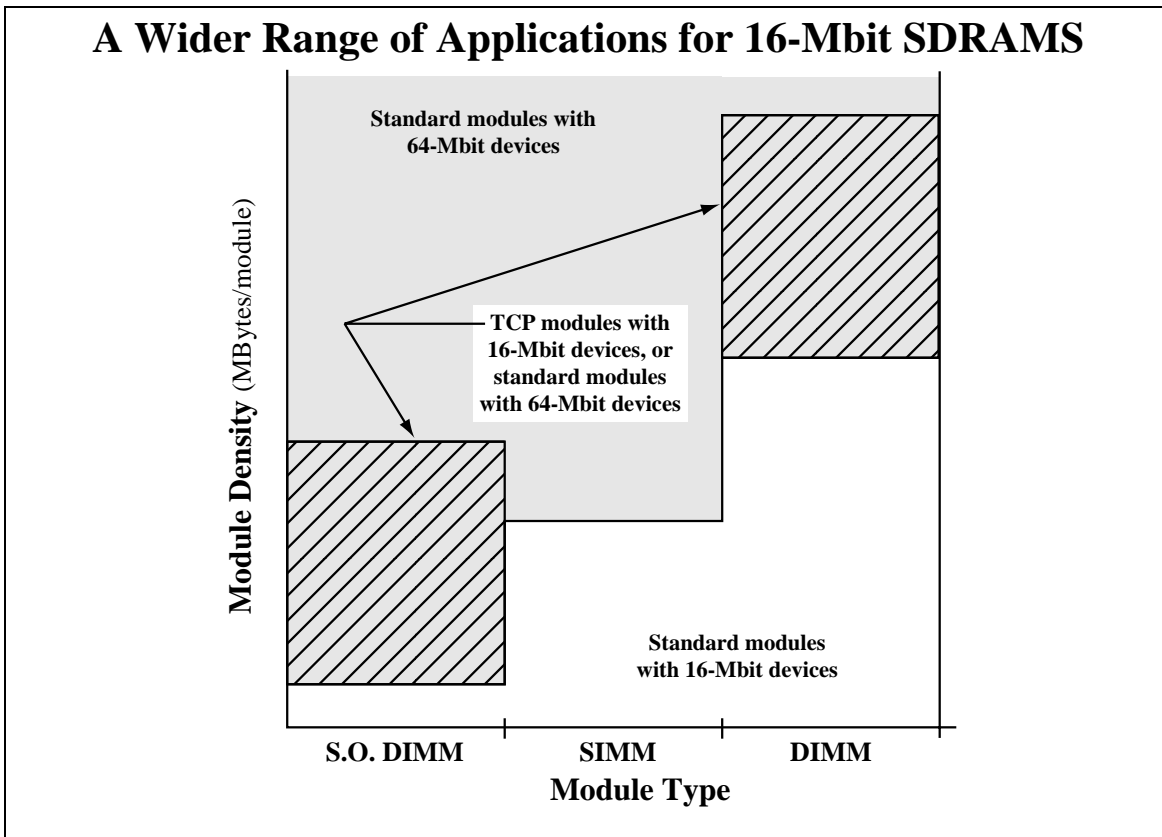


Densities of Cost-Saving 16-Mbit DRAM/SDRAM-based DIMMs Extend to 64 Mbyte

These economical plug-in main memory solutions are ideal for servers, workstations, and PCs

New 4Mx72/4Mx64, 144-pin Small Outline DIMMs (S.O. DIMMs), and 8Mx72/8Mx64, 168-pin DIMMs (Dual-Inline Memory Modules) are based on tape carrier package (TCP) 16-Mbit DRAMs and SDRAMs. These modules provide economical, high-capacity main memory solutions for notebook PCs, workstations, and PC servers that use 64-bit processors such as Intel's Pentium® and IBM's PowerPC™. Innovative packaging allows densities that previously could be achieved only with 64-Mbit chips. Cost savings are currently more than 25 percent compared to modules that use 64-Mbit devices.

The 16-Mbit-device-based modules help system OEMs to reduce cost at a time when main memory capacity requirements continue to escalate and there is tremendous pressure to reduce prices. Because 64-Mbit DRAMs and SDRAMs cost more on a price-per-bit basis, Hitachi is applying the cost advantage of 16-Mbit devices to produce lower-cost 8-Byte S.O. DIMMs and DIMMs. A 4Mx64 S.O. DIMM, for example, contains 16 tested and verified 16-Mbit devices. Moreover, since 16-Mbit chips are readily available with shorter lead times than 64-Mbit chips, these 16-Mbit-chip-based modules can be used to cut weeks off a system's time to market.

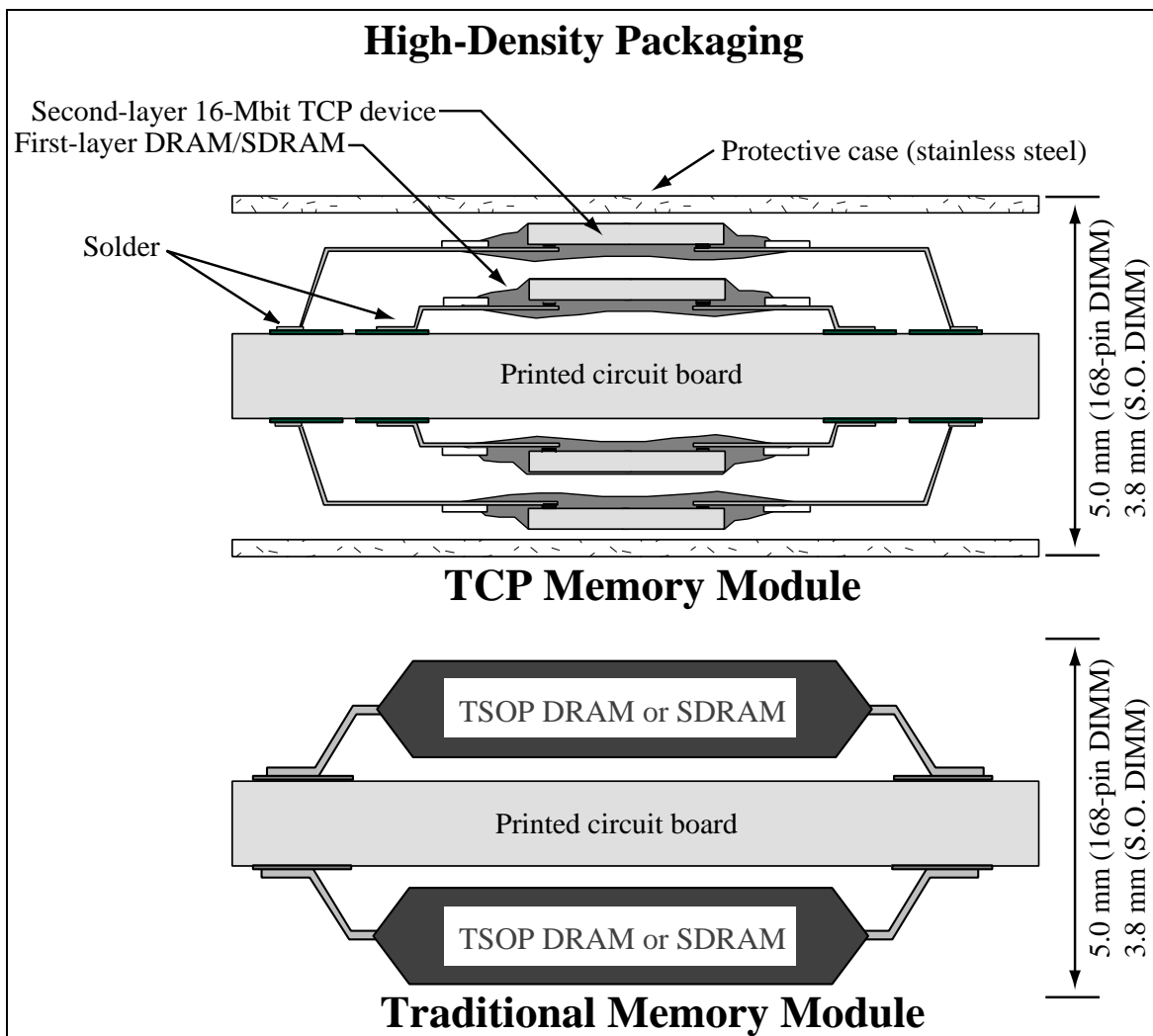


TCP 8-Byte S.O. DIMMs and DIMMs extend the application of 16-Mbit DRAMs/SDRAMs into densities previously served only by 64-Mbit device-based modules. Applications include notebook PCs, workstations, and PC servers.

Thin TCPs are the key

Tape carrier packaging produces very thin packaged devices. This is the key to extending the application of 16-Mbit DRAMs and SDRAMs into densities previously served only by 64-Mbit DRAMs and SDRAMs. With TCP, two layers of individually packaged DRAMs or SDRAMs can be stacked on top of a circuit board in the same space as that occupied by only one TSOP packaged chip. Even after four layers of TCP devices are attached to the standard-sized circuit board (two layers on each side) and covered by a protective stainless case, the assembly still meets the maximum thickness, length, and width specified by JEDEC for 8-Byte S.O. DIMMs and DIMMs.

The results of this packaging approach are reliable, cost-effective memory modules that offer twice the density of existing 16-Mbit-DRAM-based modules. These DIMMs are based on proven products and manufacturing technologies. Operation for DRAM versions is in EDO or Fast Page mode, with access times as fast as 60 ns. SDRAM versions have cycle times as fast as 10 ns. Hitachi can readily produce the memory modules in high volume for immediate availability.



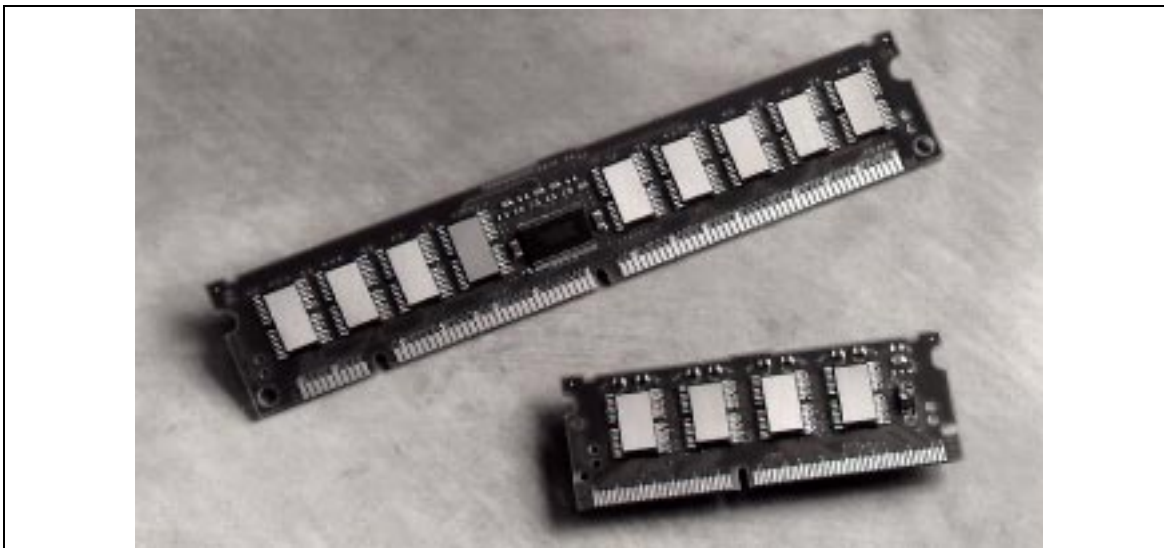
To achieve high density, tested DRAMs or SDRAMs with tape carrier packaging are stacked two high on both sides of a circuit board, then protected by a metal case. The overall thickness is less than the maximum allowed by the JEDEC specifications for DIMMs and S.O. DIMMs.

Ideal for 3.3-V and 5-V systems

For older-generation computer systems based on 5-V memory, the TCP 16-Mbit device-based 168-pin/8-Byte DIMMs provide the highest-density 5-V memory available, so they give a vast number of computer owners a cost-effective way to extend the life of their equipment. Other high-density memory modules based on 64-Mbit chips with TSOP packages typically operate from a 3.3-V power supply only, so they're unsuitable for use in the large installed base of 5-V computers.

The 8Mx72 (ECC) and 8Mx64 (non-parity) 168-pin, 8-Byte DIMMs are 1-inch-high, two-bank modules. Available in buffered and unbuffered versions for 3.3- and 5-V systems, they provide an upgrade capability for both existing systems and future designs. Refresh, either CAS-before-RAS (CBR) or RAS-only, is 4K/64 ms.

The 4Mx72 (ECC) and 4Mx64 (non-parity) 144-pin S.O. DIMMs are 1-inch-high, one-bank modules for 3.3-V systems. Unbuffered data inputs and outputs ensure maximum speeds at the module level without the addition of extra components, for the lowest possible component count and cost.



Hitachi 16-Mbit DRAM/SDRAM-based 8-byte, 168-pin DIMMs and 144-pin S.O. DIMMs can help reduce a system's overall cost and reduce its time to market

Plug and play capability

The high-density 16-Mbit-device-based modules conform to popular JEDEC standards. Common to the 8-Byte S.O. DIMMs and DIMMs is a presence detect capability. Serial circuits with nonvolatile data storage (EE-PROM) allow the CPU to automatically determine the capacity of the DIMM and the electrical characteristics of the memory devices it contains. This implements a 'plug and play' capability, whereby the memory controller 'reads' the module and optimizes the performance of the PC system to its actual main memory resources.

The plug and play capability allows system manufacturers to configure their systems just before shipment. It also lets end users perform easy system upgrades without visiting the dealer or shipping the machine to a service depot.