

Electronics

FIVE-CHIP PROCESSOR RUNS 3-D GRAPHICS AT 30 MIPS

GE'S HARDWARE SOLUTION TO SOFTWARE PROBLEM IS 100 TIMES FASTER

RESEARCH TRIANGLE PARK, N. C.

General Electric Co.'s conviction that silicon can outperform software in three-dimensional graphics processing has yielded its first product: a high-performance 3-d graphics processor that GE claims is 100 times faster than similarly priced systems. Last week, GE brought out its Graphicon 700 processor, which it calls a hardware solution to a software problem.

"Typical software bottlenecks are now replaced by hardware accelerators," says Dale W. Rowe, general manager of GE's Silicon Systems Technology Department in Research Triangle Park, one of two GE units that collaborated in the development of the Graphicon. Aimed at engineering, scientific, architectural, geophysical, and medical applications, the processor will find its first significant use in enhancements to its computer-aided design and engineering systems to be introduced by GE subsidiary Calma Co. later in the year.

The Graphicon 700 is the first product from the Silicon Systems Technology Department, a unit of GE's Semiconductor Business Division, also in Research Triangle Park. GE started the department in March 1984 as a venture aimed at producing graphics processors for internal use as well as external markets. A secondary goal has been to promote the use of very large-scale integrated-circuit technology in GE products and systems, Rowe says.

The processor is built around five semicustom 10-MHz chips developed jointly by the Silicon Systems Technology Department and GE's Simulation and Control Systems Department in Daytona Beach, Fla. The chips use 2- μ m CMOS technology and include three different-size gate arrays and one standard cell. They also

implement 3-d geometry and image-rendering algorithms derived from GE's flight-simulation technology developed in Daytona Beach. GE estimates the chips will save up to 80,000 lines of Fortran code.

Unlike software-intensive 3-d graphics processors, GE's new machine uses four pipelined processors and a multiple-bus architecture that includes a 32-bit VME-bus and three nonstandard high-bandwidth buses. The result is a processor that performs more than 30 million floating-point operations per second.

The standard graphics processor includes 4 megabytes of display-list memory and a 12-by-24 color-lookup table. Z-buffer and frame-buffer memory boards can be added for up to 16 megabytes of display-list memory. System software and microcode is stored in a separate 2-megabyte local memory.

SOLIDS ENGINE. GE's Rowe says the 3-d graphics processor is 100 times faster than comparable software-based systems.

Calma says it plans to offer the new processor as a hardware option on its 3-d mechanical computer-aided design and engineering systems, which are based on the Digital Equipment Corp. VAX and MicroVAX II, beginning in the fourth quarter. The Graphicon will enhance the systems' high-end solids-modeling capabilities, "bringing into our customers' hands some capabilities they haven't been able to use in a real design situation," says Charles Thompson, director of mechanical products for the Milpitas, Calif., company.

ULTRAFAST. Calma, which kicked in about a third of the \$20 million spent for development of the processor, says the Graphicon will display complex, 3-d images on its work stations up to five times faster than its current products for screen-refresh commands and up to 30 times faster for generation of shaded

images. Rowe claims the processor will display highly complex, solid-shaped 3-d images at rates 100 times faster than competitive systems, and says it has outperformed competing processors such as those from Raster Technologies Inc. and Silicon Graphics Inc. in 3-d solid-shaded image processing.

"With this performance, you are going to see a sharp increase in solids modeling," says Rowe. GE sees applications for the Graphicon in industrial product and biomedical-equipment design, industrial and scientific research, and molecular modeling, as well as in analysis of vibration, stress, heat-transfer, or geophysical data—in addition to CAD/CAE.

GE will offer the Graphicon 700 to original-equipment manufacturers as well as directly to users. The processor will be available immediately as a stand-alone product or as a fully configured \$65,900 system. —George Leopold

