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NEC Introduces High-Performance, Low-Power Embedded DRAM for SoC Design

-Standard CMOS-Compatible Embedded DRAM Process Enables Easy Integration of Hard Core Macros-

TOKYO, SANTA CLARA, Calif. and DUESSELDORF, Germany, August 26, 2002 - NEC Corporation (NIPNY) and its wholly owned subsidiaries in the United States and Europe, NEC Electronics Inc. and NEC Electronics (Europe) GmbH., today announced the availability of 0.13-micron (drawn) embedded DRAM technology based on NEC's high-performance embedded DRAM process. Operating at 1.2 volts (V), NEC's embedded DRAM has a typical random access speed of up to 314 megahertz (MHz) with one clock cycle latency, a typical page-mode access speed of 595 MHz, making it ideal for complex system-on-chip (SoC) designs in communications, consumer and high-end computing applications that require high speed, low latency and low power consumption. NEC's embedded DRAM is available in 8- and 9-megabit (Mb) hard macro cores and routable configurable macro cores, giving designers the flexibility to use a variety of embedded DRAM in a single SoC. NEC's low-k dielectric embedded DRAM copper process is fully compatible with its standard embedded DRAM process, which means that designers can easily integrate standard embedded DRAM with NEC's CMO intellectual property.

"NEC is committed to delivering key ASIC technologies such as embedded DRAM that ensure high performance and reliability for our customers," said Kyuichi Hareyama, general manager, Network Core LSI Development Division, NEC Electron Devices, NEC Corporation. "With our high-speed, low-power embedded DRAM compatible process technology, our customers now have the opportunity to create truly high-performance differentiated products required by the next generation of systems."

"NEC's Embedded DRAM (ML Type)"

According to market research firm, In-Stat/MDR, worldwide merchant market dollar shipments of high cell-based designs containing at least one or more blocks of DRAM, in conjunction with other embedded will grow from $95 million in 2001 to $250 million by 2006, a CAGR of 21 percent.

**Broad Range of Embedded DRAM Solutions**

NEC's embedded DRAM process is a fully qualified 0.13-micron, low-k dielectric process. The full-metal dramatically improves speed while reducing power consumption. NEC's process employs both a cylinder-stacked capacitor structure that ensures high yields and a low-temperature metal-insulated-metal (MIM) process that accelerates performance.

Unlike its commodity DRAM process, NEC's embedded DRAM process uses the same structure as its CMOS process, and thus is fully compatible with that process. This compatibility dramatically reduces time by minimizing the number of process steps needed to add embedded DRAM.

With today's announcement, NEC offers embedded DRAM solutions to support customers using the CB-12 and CB-130 ASIC libraries. The CB-12 embedded DRAM operates at 1.5 volts and up to 222 MHz in random access mode with the one clock latency typically featured in fast SRAM solutions. The CB-130 DRAM operates at 1.2 volts and up to 314 MHz (typical) in random access mode with one clock latency. Embedded DRAM process achieves these unprecedented speeds and power consumption levels by keeping parasitic resistance and capacitance low.

NEC's embedded DRAM macro uniquely allows embedded DRAM blocks to be rotated to any orientation simplifying integration with other on-chip components while preserving the performance and power benefits afforded by NEC's process. Additionally, the upper metal layers of an ASIC can be routed over embedded DRAM blocks, simplifying chip design, improving timing and conserving silicon. NEC's embedded DRAM is ideal for consumer products such as hand-held wireless devices and cell phones, high-end network including ATM switches and routers, and business tools such as printers and PC graphics cards.

**Availability**

NEC's new embedded DRAM is now available for two of NEC's ASIC libraries, CB-12 and CB-130. For CB-12 library, 4- and 8-Mb embedded DRAM configurations are currently available in sample volumes. For CB-130 library, 8- and 9-Mb embedded DRAM configurations are expected to be available in sample volumes by 2002. Embedded DRAM cores are also currently available for each library.

**About NEC Electronics Inc.**

NEC Electronics Inc., headquartered in Santa Clara, Calif., is one of the leading developers, manufacturers, and suppliers of semiconductor products in the United States. Committed to meeting customers' cost, performance, and time-to-market requirements, the company offers solutions ranging from standard products, including electron components, to system-on-a-chip (SoC) solutions, as well as customized products for next-gen designs. NEC Electronics also offers customers the benefits of a local manufacturing facility in Roseville and the global manufacturing capabilities of its parent company, NEC Corporation (NASDAQ: NIPNY). For additional information, please visit the NEC Electronics website at [http://www.necel.com](http://www.necel.com).

**About NEC Corporation**

NEC Corporation (NASDAQ: NIPNY) (FTSE: 6701q.1) is one of the world's leading providers of Internet broadband network and enterprise business solutions dedicated to meeting the specialized needs of individual and global base of customers. Ranked as one of the world's top patent-producing companies, NEC develops tailored solutions in the key fields of computer, networking and electron devices, through its three in-house companies: NEC Solutions, NEC Networks and NEC Electron Devices. NEC Corporation employs more than 140,000 people worldwide and had net sales of approximately $39 billion in the fiscal year ended March 2002. For additional information, please visit the NEC home page at [http://www.nec.com](http://www.nec.com/).

**About NEC Electronics (Europe) GmbH**

NEC Electronics (Europe) GmbH, headquartered in Duesseldorf, Germany, is a leading developer, manufacturer and supplier of semiconductor products in Europe. Committed to meeting customers' cost, performance...
to-market requirements, the company offers solutions ranging from standard products to system-on-solutions, as well as customized products for next-generation designs. NEC Electronics also offers the benefit of state-of-the-art manufacturing facilities in Ireland, and the global manufacturing capability of its parent company, NEC Corporation. For more information, visit the NEC Electronics website at http://www.ee.nec.de.

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