

On-Chip Measurement Technology for Further Miniaturization of CMOS Devices

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Along with the recent demand for low-power/high-speed electronic devices in servers, communication and information appliances, miniaturization of large-scale integration (LSI) minimum feature size has been progressing continuously. Simultaneously, the physical phenomenon determining signal integrity is very complicated, and measurement of this signal integrity is becoming increasingly difficult. Degradation of signal quality in the actual LSI cannot be fully grasped by conventional LSI development schemes, which depend on CAD tools that use signal integrity models obtained from software simulation. As a result, the design margin has had to become gradually larger. This means that even if cutting-edge CMOS is utilized in the near future, we are approaching an age where continuous improvement of LSI performance with regard to speed and power has become extremely difficult.

To solve this problem, NEC has devised a new LSI development scheme. This involves embedding a circuit that can measure degradation of signal integrity, the cause of operation errors of high-performance LSI, into mass production LSI. Through collection and analysis of the measured results retrieved during actual operations in the field, and feedback from this circuit, next-generation LSI development is promoted.

As a result of this research, needless design margins can be reduced, and a next-generation feedback-capable LSI development scheme based on precise degradation prediction is realized enabling high-performance LSI. The need for repetitive creation of LSI prototypes can be prevented due to the measurement of signal integrity during actual operations, which achieves shorter development time and faster time to market. NEC and NEC Electronics have started applying this technology to special products, enabling us to provide our customers with the earliest adoption of our highly reliable, cutting-edge technology.

Keywords:

LSI: Large Scale Integration: A chip technology where many components are combined on a single chip.

CMOS: Complementary Metal Oxide Semiconductor; CMOS is the semiconductor technology that is currently employed for manufacturing LSIs such as microprocessors and memories.

Signal integrity: The quality, accurate reconstruction, or accurate simulation of electrical signals and power waveforms that are determined by physical phenomenon not only in chips but also in LSI packages and printed circuit boards (PCBs) and whose behavior will be changed according to the operating patterns determined by software program and input data.