NANOTECHNOLOGY

Device Design and Applications

Edited by
SHILPI BIRLA
NEHA SINGH
NEERAJ KUMAR SHUKLA

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1 An Overview of Current Trends in Hafnium Oxide–Based Resistive Memory Devices

Lalit Kumar Lata, Praveen Kumar Jain, and Abhinandan Jain
Department of Electronics & Communication Engineering,
Swami Keshvanand Institute of Technology,
Management & Gramothan, Jaipur, India

Deepak Bhatia
Department of Electronics & Communication Engineering,
Rajasthan Technical University, Kota, India

1.1 INTRODUCTION

Memory is a core component of any computing device because it stores data and programs. The main memory of the computing device directly communicates with the CPU. It holds the program and data currently required by the processor of the computer. Memory devices used for storage and backup are called auxiliary memory, and they contain large files and data. Magnetic disks and tapes are examples of auxiliary memory. Auxiliary memory stores all the other information, and this information is transferred to the computer's main memory when needed. Main memory is the central stage in a computer system, and it stores data and programs during the operation of a computer. The principal operation used in main memory is a semiconductor integrated circuit. RAM is an example of main memory.

RAM was initially used for random access memory but is now used to designate read/write memory. It may be volatile or nonvolatile. In volatile memory, all the data are destroyed when the power supply is removed, whereas in nonvolatile memory, there is no loss of data, even if the power supply is switched off. RAM has two types: SRAM (static RAM) and DRAM (dynamic RAM). These memory devices have their benefits and drawbacks. For example, the capacity and density of DRAM are high, but this memory is volatile, and power consumption is high because it needs to be refreshed every second. SRAM is fast but volatile, and large memory cells reduce its capacity. Compared to RAM, flash

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