

2018-2023 Global Ferroelectric RAM Consumption Market Report

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Abstracts

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In this report, LP Information covers the present scenario (with the base year being 2017) and the growth prospects of global Ferroelectric RAM market for 2018-2023.

Ferroelectric RAM (FeRAM, F-RAM or FRAM) is a random-access memory similar in construction to DRAM but utilizing a ferroelectric layer instead of a dielectric layer to achieve non-volatility. FeRAM is one of a growing number of alternative non-volatile random-access memory technologies which can offer that same functionality as flash memory.

FeRAM consists of a grid of small capacitors and associated wiring and signaling transistors. Each storage element, a cell, consists of one capacitor and one transistor. Unlike the DRAM use a linear dielectric in its cell capacitor, dielectric structure in the FeRAM cell capacitor usually contains ferroelectric material, typically lead zirconate titanate (PZT).

A ferroelectric material has a nonlinear relationship between the applied electric field and the apparent stored charge. The ferroelectric characteristic has the form of a hysteresis loop, which is very similar in shape to the hysteresis loop of ferromagnetic materials. The dielectric constant of a ferroelectric is typically much higher than that of a linear dielectric because of the effects of semi-permanent electric dipoles formed in the crystal structure of the ferroelectric material. When an external electric field is applied across a dielectric, the dipoles tend to align themselves with the field direction, produced by small shifts in the positions of atoms and shifts in the distributions of electronic charge in the crystal structure. After the charge is removed, the dipoles retain

their polarization state. Binary "0"s and "1"s are stored as one of two possible electric polarizations in each data storage cell. For example, in the figure a "1" is encoded using the negative remnant polarization "-Pr", and a "0" is encoded using the positive remnant polarization "+Pr". In terms of operation, FeRAM is similar to DRAM. Writing is accomplished by applying a field across the ferroelectric layer by charging the plates on either side of it, forcing the atoms inside into the "up" or "down" orientation (depending on the polarity of the charge), thereby storing a "1" or "0". Reading, however, is somewhat different than in DRAM. The transistor forces the cell into a particular state, say "0". If the cell already held a "0", nothing will happen in the output lines. If the cell held a "1", the re-orientation of the atoms in the film will cause a brief pulse of current in the output as they push electrons out of the metal on the "down" side. The presence of this pulse means the cell held a "1". Since this process overwrites the cell, reading FeRAM is a destructive process, and requires the cell to be re-written if it was changed.

Ferroelectric RAM was proposed by MIT graduate student Dudley Allen Buck in his master's thesis, *Ferroelectrics for Digital Information Storage and Switching*, published in 1952. Development of FeRAM began in the late 1980s. Work was done in 1991 at NASA's Jet Propulsion Laboratory on improving methods of read out, including a novel method of non-destructive readout using pulses of UV radiation. Much of the current FeRAM technology was developed by Ramtron, a fabless semiconductor company. One major licensee is Fujitsu, who operates what is probably the largest semiconductor foundry production line with FeRAM capability. Since 1999 they have been using this line to produce standalone FeRAMs, as well as specialized chips (e.g. chips for smart cards) with embedded FeRAMs. Fujitsu produced devices for Ramtron until 2010. Since 2010 Ramtron's fabricators have been TI (Texas Instruments) and IBM. Since at least 2001 Texas Instruments has collaborated with Ramtron to develop FeRAM test chips in a modified 130 nm process. In the fall of 2005, Ramtron reported that they were evaluating prototype samples of an 8-megabit FeRAM manufactured using Texas Instruments' FeRAM process. Fujitsu and Seiko-Epson were in 2005 collaborating in the development of a 180 nm FeRAM process. In 2012 Ramtron was acquired by Cypress Semiconductor. FeRAM research projects have also been reported at Samsung, Matsushita, Oki, Toshiba, Infineon, Hynix, Symetrix, Cambridge University, University of Toronto, and the Interuniversity Microelectronics Centre (IMEC, Belgium).

Over the next five years, LPI(LP Information) projects that Ferroelectric RAM will register a 3.7% CAGR in terms of revenue, reach US\$ 300 million by 2023, from US\$ 240 million in 2017.

This report presents a comprehensive overview, market shares, and growth

opportunities of Ferroelectric RAM market by product type, application, key manufacturers and key regions.

To calculate the market size, LP Information considers value and volume generated from the sales of the following segments:

Segmentation by product type:

Serial Memory

Parallel Memory

Others

Segmentation by application:

Smart Meters

Automotive Electronics

Medical Devices

Wearable Devices

This report also splits the market by region:

Americas

United States

Canada

Mexico

Brazil

APAC

China

Japan

Korea

Southeast Asia

India

Australia

Europe

Germany

France

UK

Italy

Russia

Spain

Middle East & Africa

Egypt

South Africa

Israel

Turkey

GCC Countries

The report also presents the market competition landscape and a corresponding detailed analysis of the major vendor/manufacturers in the market. The key manufacturers covered in this report:

Cypress Semiconductor

Fujitsu

Texas Instruments

IBM

Infineon

...

In addition, this report discusses the key drivers influencing market growth, opportunities, the challenges and the risks faced by key manufacturers and the market as a whole. It also analyzes key emerging trends and their impact on present and future development.

Research objectives

To study and analyze the global Ferroelectric RAM consumption (value & volume) by key regions/countries, product type and application, history data from 2013 to 2017, and forecast to 2023.

To understand the structure of Ferroelectric RAM market by identifying its various subsegments.

Focuses on the key global Ferroelectric RAM manufacturers, to define, describe and analyze the sales volume, value, market share, market competition landscape, SWOT analysis and development plans in next few years.

To analyze the Ferroelectric RAM with respect to individual growth trends, future prospects, and their contribution to the total market.

To share detailed information about the key factors influencing the growth of the

market (growth potential, opportunities, drivers, industry-specific challenges and risks).

To project the consumption of Ferroelectric RAM submarkets, with respect to key regions (along with their respective key countries).

To analyze competitive developments such as expansions, agreements, new product launches, and acquisitions in the market.

To strategically profile the key players and comprehensively analyze their growth strategies.

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