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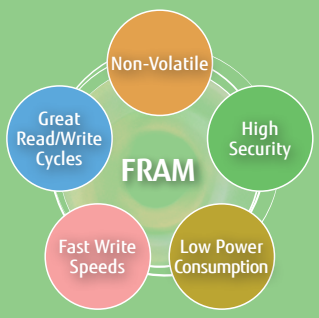
FUJITSU Semiconductor FRAM

shaping tomorrow with you

FUJITSU SEMICONDUCTOR LIMITED

Fujitsu's Non-Volatile Memory, FRAM

Fujitsu continues to strive forward with customers who seek



What is FRAM?

FRAM (Ferroelectric RAM) is a non-volatile and random access memory (RAM) which retains stored data even when power is turned off. As compared with conventional types of non-volatile memory, such as EEPROM (Electrically Erasable and Programmable Read-Only Memory) and Flash memory, FRAM exhibits superior performance through faster write speeds, greater read/write cycle endurance and lower power consumption.

Since we started mass production of FRAM in 1999, Fujitsu Semiconductor has been assuring a high quality and stable supply of FRAM products to our valued customers for more than 15 years.

For more information, please visit: FRAM Search

innovation

FRAM Features

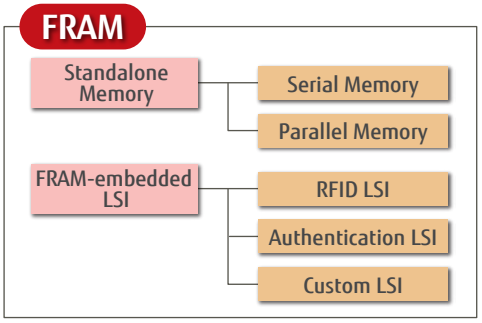
- Non-volatile
- Random Access
- Fast Write Speed
- High Read/Write Cycle Endurance
- Low Power Consumption

Comparison between FRAM and other memories

	FRAM	EEPROM	FLASH	SRAM
Memory Type	Non-volatile	Non-volatile	Non-volatile	Volatile
Write Method	Overwrite	Erase + Write	Erase + Write	Overwrite
Write Cycle Time	150ns	5ms	10µs	55ns
Read/Write Cycles	10^{13}	10^{6}	10^{5}	Unlimited
Booster Circuit	No	Yes	Yes	No
Data Backup Battery	No	No	No	Yes

FRAM Product Families

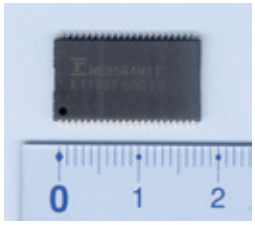
Can be divided into two product families. One is "Standalone Memory," which is used for easy implementation. Another is "FRAM-embedded LSIs," such as RFID LSIs and authentication LSIs. These are built already embedded with FRAM.
Fujitsu also offers custom LSIs optimized for customer applications.



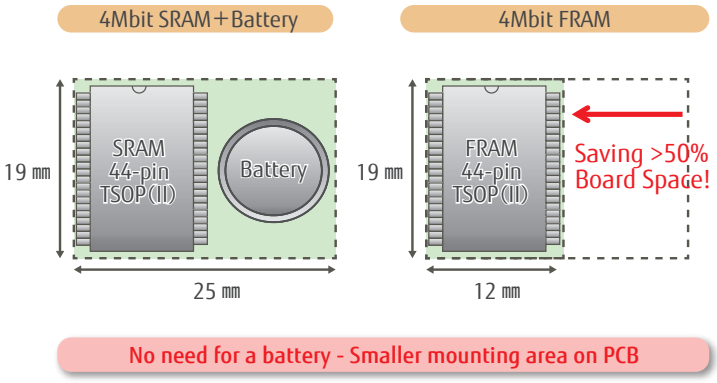
Topics

SRAM-compatible Non-Volatile Memory, Parallel interface 4Mbit FRAM

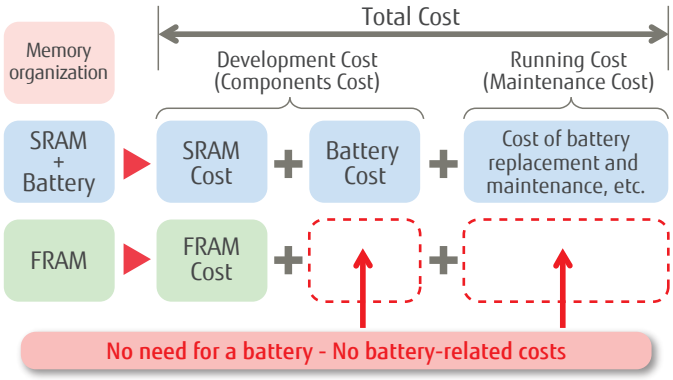
Fujitsu developed MB85R4M2T, which features a 4Mbit parallel interface FRAM product. The device uses a 44-pin TSOP package compatible with standard low-power SRAM, so it can substitute for SRAM in industrial machinery, metering, medical devices, and other equipment that currently uses SRAM.
Fujitsu FRAM is used for storing data persistently with no need for a battery. FRAM contributes to hardware that is more compact, more eco-friendly, and lower-cost.



Mounting Area Comparison

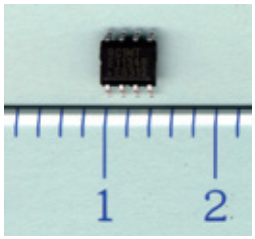


Total Cost Comparison

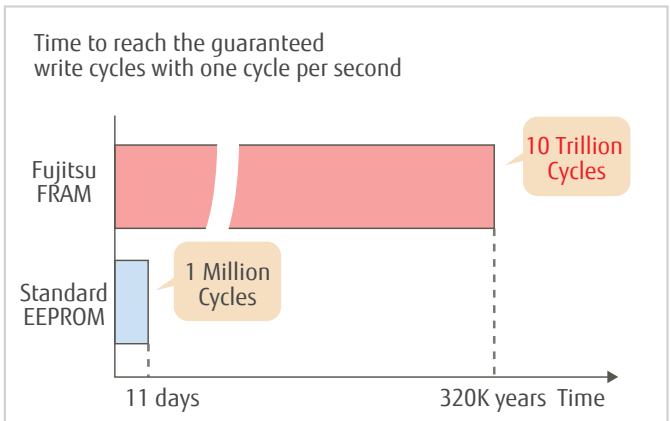


Serial EEPROM Compatible Non-Volatile Memory, I²C Interface 1M-bit FRAM

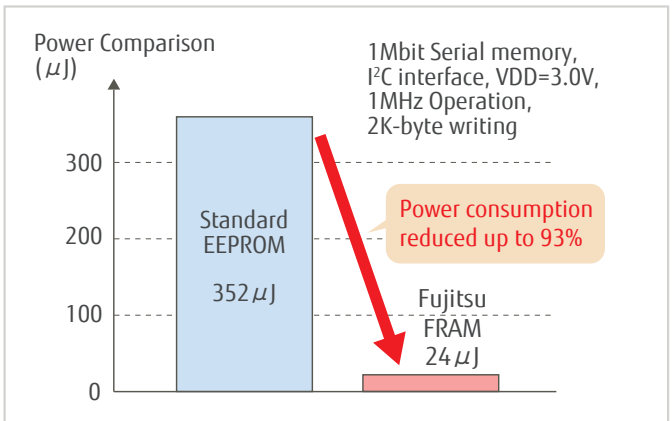
Fujitsu developed a new 1Mbit FRAM product, the MB85RC1MT, which has the highest memory density of our products with an I²C serial interface.
The new product is guaranteed for up to 10 trillion read/write cycles, and is optimal for usage in applications requiring frequent rewriting of data, such as real-time data logging for factory-automation, metering, and industrial equipment. FRAM features faster write time than that of conventional non-volatile memory such as EEPROM and Flash memory. It enables lower power consumption during writing.



Guaranteed Write Cycles Comparison

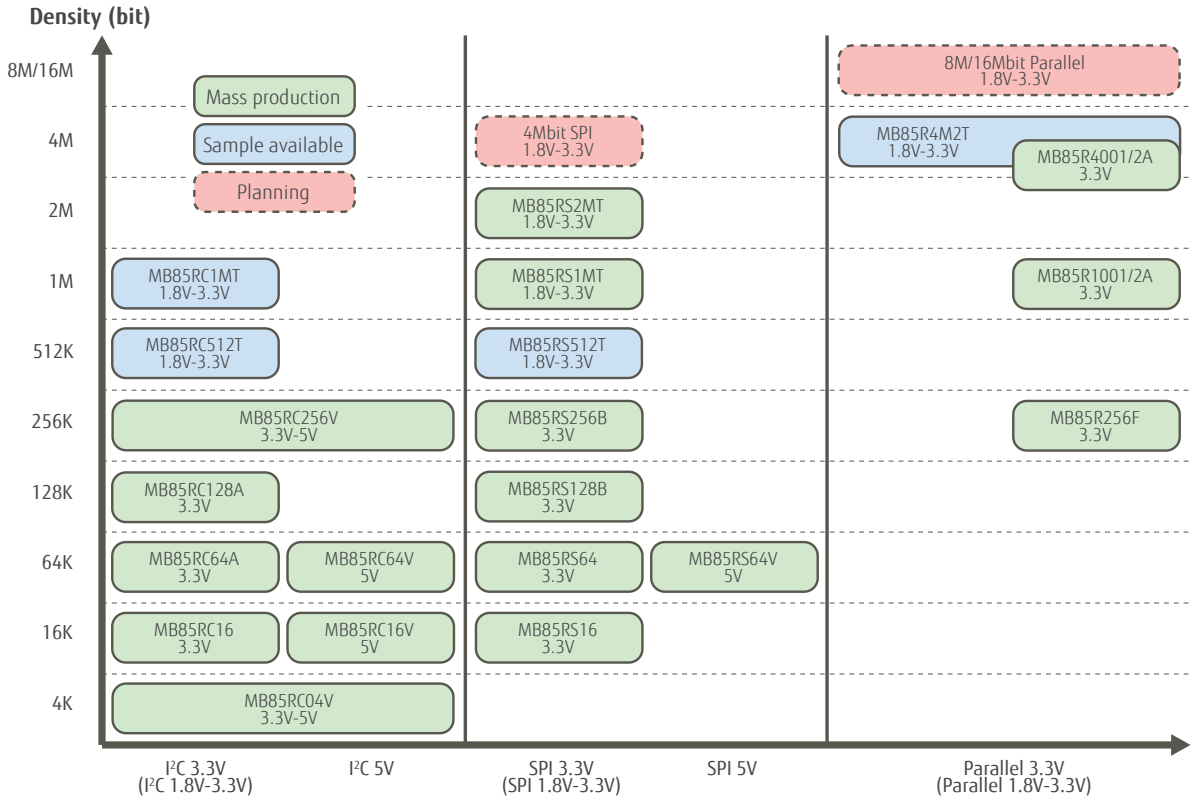


Write Power Consumption Comparison



Product Lineup

Fujitsu Semiconductor provides FRAM products with wide density ranges, from 4Kbit to 1Mbit for the I²C interface and 16Kbit to 2Mbit for the SPI interface. Both I²C and SPI interface memories have 8pin-SOP packages, so customers can easily replace EEPROM and Flash memory with FRAM. This lowers the burden of PCB design while contributing to improved application performance.
For parallel interface products, 256Kbit to 4Mbit densities are available. These products are suitable for applications which require removal of the battery while using SRAM.
To meet the demand of customers that require large density memory, Fujitsu plans to expand its product line with large density products.



Example of Application using FRAM

FRAM is an ideal non-volatile memory for various applications due to its high performance, low power consumption, extremely fast write speeds, and its 10-trillion read/write cycle guarantee. Due to the fact that data is protected even in the event of a sudden power loss, our products have been utilized in equipment that requires high reliability, such as in power meters, factory-automation, and financial equipment. They are often used for data logging and storing parameters.

OA Equipment
Counters and parameter data storage

SSD
Cache memory, logging management

Amusement
Resume and parameter data storage

ATM
Transaction history, logging management

Audio, AV Equipment
Resume and parameter data storage

Communication Equipment
Communication history and logging management

Measurement and Analyzing Equipment
Measuring data and revised data storage

FA
Parameter data storage, logging management

Medical, Pharmaceutical
Sterilization and examination records

Traceability Management in Distribution
Transportation, logistics, and warehousing records

Standalone Memory

Serial Memory

Serial interface FRAM products with up to 2Mbits are available, and they are compatible with EEPROM and serial Flash memories. Compared to other conventional non-volatile memories, FRAM products have the advantages of fast write speeds, greater read/write cycle endurance, and low power consumption.

● I^2C Interface

Part Number	Memory Density	Power supply voltage	Operating frequency (MAX)	Operating temperature	Read/Write cycles	Data retention (*1)	Package
MB85RC1MT	1Mbit	1.8 to 3.6V	3.4MHz	-40 to +85℃	10 trillion 10^{13} times	10 years (+85℃)	SOP-8
MB85RC512T	512Kbit	1.8 to 3.6V	3.4MHz	-40 to +85℃	10 trillion 10^{13} times	10 years (+85℃)	SOP-8
MB85RC256V	256Kbit	2.7 to 5.5V	1MHz	-40 to +85℃	1 trillion 10^{12} times	10 years (+85℃)	SOP-8
MB85RC128A	128Kbit	2.7 to 3.6V	1MHz	-40 to +85℃	1 trillion 10^{12} times	10 years (+85℃)	SOP-8
MB85RC64A	64Kbit	2.7 to 3.6V	1MHz	-40 to +85℃	1 trillion 10^{12} times	10 years (+85℃)	SOP-8
MB85RC64V	64Kbit	3.0 to 5.5V	1MHz	-40 to +85℃	1 trillion 10^{12} times	10 years (+85℃)	SOP-8
MB85RC16	16Kbit	2.7 to 3.6V	1MHz	-40 to +85℃	1 trillion 10^{12} times	10 years (+85℃)	SOP-8/SON-8
MB85RC16V	16Kbit	3.0 to 5.5V	1MHz	-40 to +85℃	1 trillion 10^{12} times	10 years (+85℃)	SOP-8
MB85RC04V	4Kbit	3.0 to 5.5V	1MHz	-40 to +85℃	1 trillion 10^{12} times	10 years (+85℃)	SOP-8

*1: When operating temperature is lower than +85°C, data retention period can be extended. Please refer to datasheet.

● SPI Interface

Part Number	Memory Density	Power supply voltage	Operating frequency (MAX)	Operating temperature	Read/Write cycles	Data retention (*1)	Package
MB85RS2MT	2Mbit	1.8 to 3.6V	25MHz (*2)	-40 to +85℃	10 trillion 10^{13} times	10 years (+85℃)	SOP-8/DIP-8
MB85RS1MT	1Mbit	1.8 to 3.6V	30MHz (*2)	-40 to +85℃	10 trillion 10^{13} times	10 years (+85℃)	SOP-8
MB85RS512T	512Kbit	1.8 to 3.6V	30MHz (*2)	-40 to +85℃	10 trillion 10^{13} times	10 years (+85℃)	SOP-8
MB85RS256B	256Kbit	2.7 to 3.6V	33MHz	-40 to +85℃	1 trillion 10^{12} times	10 years (+85℃)	SOP-8
MB85RS128B	128Kbit	2.7 to 3.6V	33MHz	-40 to +85℃	1 trillion 10^{12} times	10 years (+85℃)	SOP-8
MB85RS64	64Kbit	2.7 to 3.6V	20MHz	-40 to +85℃	1 trillion 10^{12} times	10 years (+85℃)	SOP-8
MB85RS64V	64Kbit	3.0 to 5.5V	20MHz	-40 to +85℃	1 trillion 10^{12} times	10 years (+85℃)	SOP-8
MB85RS16	16Kbit	2.7 to 3.6V	20MHz	-40 to +85℃	1 trillion 10^{12} times	10 years (+85℃)	SOP-8/SON-8

*1: When operating temperature is lower than +85°C, data retention period can be extended. Please refer to datasheet.
*2: Maximum 40MHz operation is available at fast read mode.

Parallel Memory

FRAM products with parallel interfaces, which are compatible with SRAM interfaces, are replaceable with pseudo SRAM (PSRAM).

Part Number	Memory Density (configuration)	Power supply voltage	Cycle time	Operating temperature	Read/Write cycles	Data retention (*1)	Package
MB85R4M2T	4Mbit (256K×16)	1.8 to 3.6V	150ns	-40 to +85℃	10 trillion 10^{13} times	10 years (+85℃)	TSOP-44
MB85R4001A	4Mbit (512K×8)	3.0 to 3.6V	150ns	-40 to +85℃	10 billion 10^{10} times	10 years (+55℃)	TSOP-48
MB85R4002A	4Mbit (256K×16)	3.0 to 3.6V	150ns	-40 to +85℃	10 billion 10^{10} times	10 years (+55℃)	TSOP-48
MB85R1001A	1Mbit (128K×8)	3.0 to 3.6V	150ns	-40 to +85℃	10 billion 10^{10} times	10 years (+55℃)	TSOP-48
MB85R1002A	1Mbit (64K×16)	3.0 to 3.6V	150ns	-40 to +85℃	10 billion 10^{10} times	10 years (+55℃)	TSOP-48
MB85R256F	256Kbit (32K×8)	2.7 to 3.6V	150ns	-40 to +85℃	1 trillion 10^{12} times	10 years (+85℃)	TSOP-28/SOP-28

*1: When operating temperature is lower than maximum temperature (+55°C or +85°C), data retention period can be extended. Please refer to datasheet.

FRAM-embedded LSI

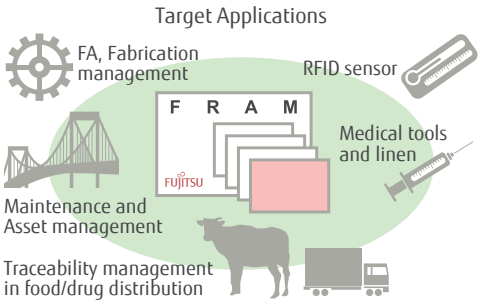
Fujitsu Semiconductor offers FRAM-embedded LSIs, such as RFID and authentication LSIs, which utilize the strengths of FRAM, such as high write speeds, high read/write endurance and low power consumption.

LSI for FRAM RFID Tag

Fujitsu supports FRAM-embedded LSI products for RFID tags with 13.56MHz HF bands and 860-960MHz UHF bands. Leveraging the advantages of fast write speeds and high read/write cycle endurance, we are expanding worldwide to support the passive RFID tag needs of high-density data carriers.

Key Features

- Improves throughput with faster write speeds
- Due to the low power consumption, there is no degradation due to transmission distance.
- Larger memory density allows for data storage on the tag
- Up to 1 trillion read/write cycles allowing frequent data logging and long term use
- Conforms to International Standards: ISO15693, ISO18000-3, 6.



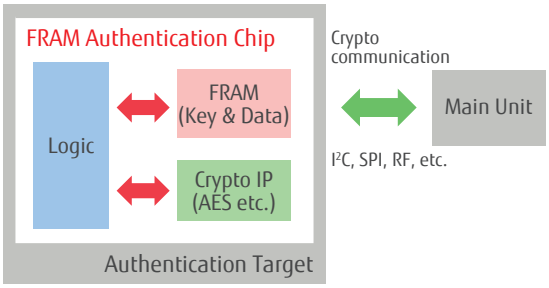
Lineup of LSI for FRAM RFID Tag

Operating frequency	Communication distance	Memory density		
		36byte to 256byte	2Kbyte to 4Kbyte	9Kbyte
UHF Band 860-960MHz	3m	MB97Rxxxx (Under development) · FRAM 36B (EPC 128bit)	MB97R803A MB97R804B · FRAM 4KB · SPI I/F	—
HF Band 13.56MHz	50cm	MB89R119B · FRAM 256B	MB89R118C · FRAM 2KB	MB89R112 · FRAM 9KB · SPI I/F

Part number	Operating frequency	Memory density	Commands	Serial interface	Data retention	Read/Write cycles
MB97R803A	UHF 860-960MHz	4KByte	ISO/IEC18000-6C EPC C1G2 Ver.1.2.0	—	10 years (+55℃)	10 billion 10^{10} times
MB97R804B	UHF 860-960MHz	4KByte	ISO/IEC18000-6C EPC C1G2 Ver.1.2.0	SPI	10 years (+55℃)	10 billion 10^{10} times
MB97Rxxxx (Under development)	UHF 860-960MHz	36Byte (EPC128bit)	ISO/IEC18000-6C EPC C1G2 Ver.1.2.0	—	10 years (+55℃)	10 billion 10^{10} times
MB89R118C	HF 13.56MHz	2KByte	ISO/IEC15693	—	10 years (+85℃)	1 trillion 10^{12} times
MB89R119B	HF 13.56MHz	256Byte	ISO/IEC15693	—	10 years (+85℃)	1 trillion 10^{12} times
MB89R112	HF 13.56MHz	9KByte	ISO/IEC15693	SPI	10 years (+85℃)	1 trillion 10^{12} times

FRAM-embedded Authentication LSI

FRAM has been used in various security applications. Fujitsu's Authentication LSI with embedded FRAM uses a Challenge and Response authentication loop between the host system and its peripherals to differentiate between authorized and counterfeit parts.
This LSI detects unauthorized, fake peripherals and accessories and is suited for equipment such as printers and MFPs.



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