FUJITSU Semiconductor FRAM

FUJITSU SEMICONDUCTOR LIMITED

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shaping tomorrow with you

FUJITSU SEMICONDUCTOR LIMITED

"FRAM", high quality and high reliability non-volatile memory with matured manufacturing experiences

Fujitsu Limited has offered a continuous stream of memory products for more than 46 years since 1969. Today Fujitsu Semiconductor Limited offers products based on Ferroelectric Random Access Memory (FRAM), a type of high quality, high reliability non-volatile memory.

Development of FRAM began in 1995, and Fujitsu has a track record of more than 17 years of mass production. Fujitsu has previously received inquiries from customers in 43 countries all over the world regarding a diverse range of more than 200 types of applications.

FRAM has been employed for smart cards and RFID tags (Radio Frequency IDentification tags, i.e., electronic tags) in the customer applications, and also for power meters, automation machinery, medical RFID tags in the industrial applications.

According to recent applications for IoT (internet of things), ultra-low power consumption, high speed and high read/ write endurance non-volatile memory is needed. FRAM is most suitable memory for such demands and Fujitsu has been provided with our FRAM for wearable devices, industrial robots, and drones etc.

Through high quality and stable product supply backed up by our superior technical capabilities, Fujitsu has offered our FRAM to customers who need memory reliability.

Fujitsu continues developing memory products that are suitable for customer applications while striving to lower power consumption, extend the operating temperature range, and increase density.

FRAM Features

Because FRAM has both features of a random accessibility and non-volatility, it works as working memory and also can store 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.

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

Fujitsu has two categorized FRAM products. One is "Standalone Memory," for general implementation usages. Another is "FRAM-embedded LSIs," which is customer designed used, such as RFID LSIs and authentication LSIs.

Fujitsu has also developed FRAM-embedded LSIs which can give the maximum superiority and performance according to customer requirements.
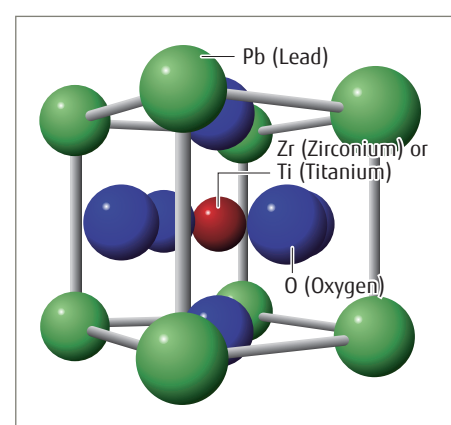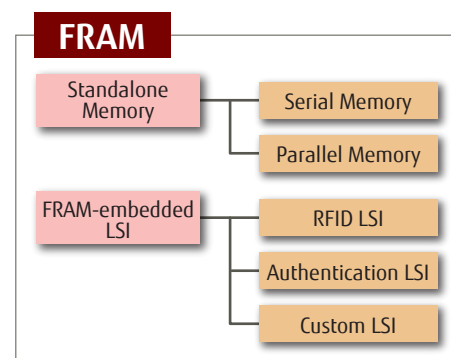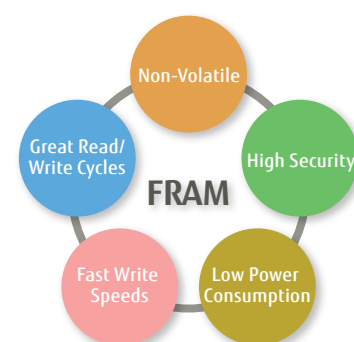
FRAM Structure

Fujitsu uses PZT (lead zirconate titanate) as a ferroelectric material in our FRAM. The crystalline structure of PZT is shown in the figure on the right.

The zirconium or titanium positive ion occupies two stable positions in the lattice, and can be moved between the positions by applying an external electric field. Since the two stable positions are slightly displaced from the charge center, electric polarization with two opposite direction, up or down in the figure, appears in the ferroelectric material. Either up or down polarization can be stored even if the electric field is removed and can be switched between each other if the opposite field is applied.

Fujitsu can define the data "0" and "1" as "up polarization" and "down polarization" of the ferroelectric film, respectively. When an electric field is applied to a ferroelectric capacitor which is comprised of two electrodes sandwiched a ferroelectric film, a non-linear polarization-electric field (P-E) relation is obtained, which is called "P-E hysteresis curve".

Switching the polarization direction by applying an electric field to rewrite the data is generally much faster than the rewriting speed of floating gate memories, such as EEPRAM and Flash memory, which use electron tunneling through silicon dioxide film by applying high voltage for data rewriting.

FRAM

Non-Volatile

Great Read/Write Cycles

High Security

FRAM

Fast Write Speeds

Low Power Consumption

FRAM

Standalone Memory	→	Serial Memory
	→	Parallel Memory
FRAM-embedded LSI	→	RFID LSI
	→	Authentication LSI
	→	Custom LSI

Pb (Lead)

Zr (Zirconium) or Ti (Titanium)

O (Oxygen)

Crystalline Structure of Ferroelectric Memory

Product Lineup

Fujitsu provides with FRAM from 16Kbit to 4Mbit for the SPI interface and from 4Kbit to 1Mbit for the I²C interface. Operating voltage of all those products is 3.3V now, however, Fujitsu has been developing 1.8V-operation FRAMs. Fujitsu can offer serial I/O FRAMs with 8-pin SOP packages for replacement of EEPROM, and also with SON (Small Outline Non-leaded package) and WL-CSP (Wafer Level Chip Size Package) for equipping in the wearable devices.

For parallel interface FRAM from 256Kbit to 4Mbit are available with TSOP packages. 256Kbit FRAM with SOP package is also available. These products are suited for replacement of battery back-upped SRAM and applications of low power consumption devices.

Density (bit)

Mass Production
Sampling
Planning

Density	I²C	SPI	Parallel
8M/16M			8M/16Mbits 1.8V-3.3V
4M		MB85RQ4ML 1.8V	MB85R4M2T 1.8V-3.3V / MB85R4001/2A 3.3V
2M		MB85RS2MT 1.8V-3.3V	
1M	MB85RC1MT 1.8V-3.3V	MB85RS1MT 1.8V-3.3V	MB85R1001/2A 3.3V
512K	MB85RC512T 1.8V-3.3V	MB85RS512T 1.8V-3.3V	
256K	MB85RC256V 3.3V-5V	MB85RS256B 3.3V	MB85R256F 3.3V
128K	MB85RC128A 3.3V	MB85RS128B 3.3V	
64K	MB85RC64TA 1.8V-3.3V / MB85RC64A 3.3V / MB85RC64V 5V	MB85RS64 3.3V / MB85RS64V 5V	
16K	MB85RC16 3.3V / MB85RC16V 5V	MB85RDP16LX(*) 1.8V / MB85RS16/16N 3.3V	
4K	MB85RC04V 3.3V-5V	*: with binary counter function	

I²C 1.8V / I²C 3.3V / I²C 5V / SPI 1.8V / SPI 3.3V / SPI 5V / Parallel 3.3V (Parallel 1.8V-3.3V)

Applications suited for FRAM

Since FRAM has strong features of fast write and 10 trillion read/write cycles guaranteed, FRAM is used in applications requiring continuous rewriting of data, real-time recording of three-dimensional information, and robust protection of data.

Fujitsu offers solutions to meet customer requirements, such as "the need to eliminate data retention batteries," "the need for memory that enables data to be read/written many times," and "the need to retain data immediately before power is cut off."

Flight Recorders/ Drive Recorders
• Drones
• Car Navigation Systems

Wearable Devices
• Smart Watches
• Hearing Aids

Robots
• Industrial Robots
• Consumer Robots

Lighting
• Lighting Equipment
• Traffic Lights

Networking
• Routers
• RAID Controllers

Metering
• Power Meters
• Gas, Water Meters

Medical
• Disposable products
• Medical Monitors

Industry Machines
• Motors, Rotary Encoders
• CNC, Control Units

IC Cards
• Security ID Cards
• IC Cards for Transportation

Remarkable Products

1Mbit Serial FRAM in Ultra-Compact Packaging
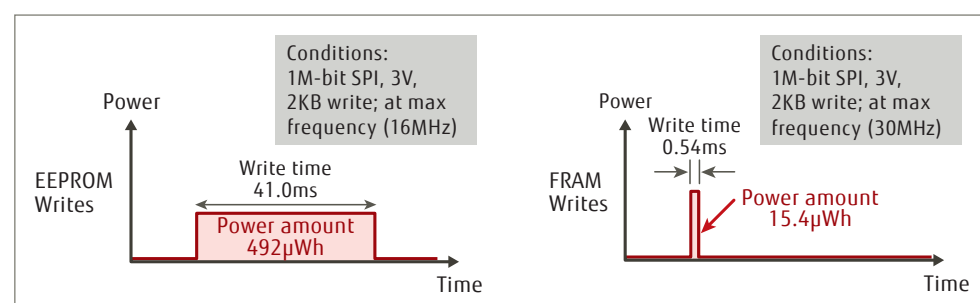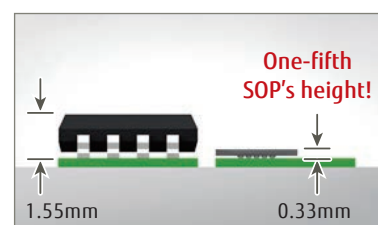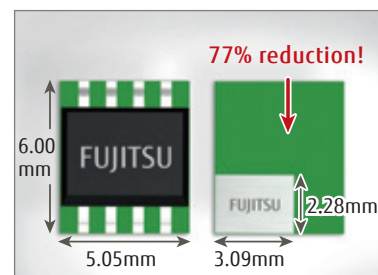
Fujitsu developed 1Mbit FRAM "MB85RS1MT", in an 8-pin wafer level chip scale package (WL-CSP). This new package occupies only 23% of the mounted surface area compared with the existing 8-pin small-outline package (SOP), or a 77% reduction in the area. Furthermore, with a thickness of only 0.33 mm, its roughly half that of a credit card, the total mounted volume resulted in 95% less than that of the SOP.

One of the benefits of MB85RS1MT is its low-power operation. Compared to the EEPROM non-volatile memory, write operations are faster as well, thereby, consume quite a small amount of power during write operations. For this reason, using this FRAM in wearable devices that need frequent write operation for real-time logging, brings the benefits of both better battery life and smaller size.

77% reduction!

6.00 mm

5.05mm   3.09mm   2.28mm

One-fifth SOP's height!

1.55mm   0.33mm

Comparison of mounted surface area and mounted height

Conditions:
1M-bit SPI, 3V, 2KB write; at max frequency (16MHz)

Conditions:
1M-bit SPI, 3V, 2KB write; at max frequency (30MHz)

Power

EEPROM Writes

Write time 41.0ms

Power amount 492μWh

Time

Power

FRAM Writes

Write time 0.54ms

Power amount 15.4μWh

Time

Amount of power consumption during write operation
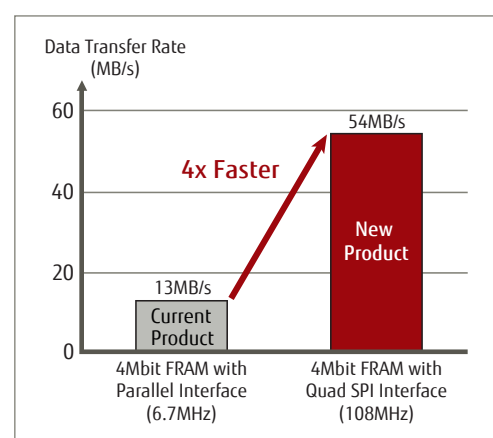
4Mbit Quad SPI FRAM Capable of 54 MB/s Data Transfer

Fujitsu developed 4Mbit FRAM "MB85RQ4ML", which represents the highest density in the non-volatile RAM market with a quad SPI interface.

This product uses a 1.8V single power supply and quad SPI interface, and is capable of 54 MB/s data transfer with 108 MHz operation. Among Fujitsu Semiconductor's previous products, 4Mbit FRAM with 16-bit parallel interfaces in 44-pin TSOP package was the fastest at 13 MB/s, however this product enables approximately 4 times the data read/write speed with less pin counts.

Its high-speed operation and non-volatile memory make it ideal for use in the networking, RAID controller, and industrial computing fields.
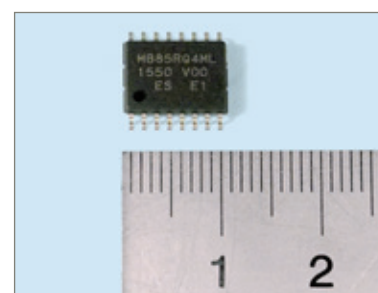
16-pin SOP Package

Data Transfer Rate (MB/s)

60

54MB/s

4x Faster

40

New Product

20

13MB/s

Current Product

0

4Mbit FRAM with Parallel Interface (6.7MHz)

4Mbit FRAM with Quad SPI Interface (108MHz)

Data Transfer Rate Comparison

3 Kinds of Memories in a Router			
Required Features for Memory	・Non-Volatility ・Large Density	・Non-Volatility ・Fast Access	・Fast Access ・Large Density
Mission of Memory	To Store OS, Important Data	To Store Updated Setting, Data for Backup	Working Memory
Information Stored	OS, Important Data	Config. Register, Start-up Setting, Event logging	Operating Setting, Processing Data
Memory Proposed	Flash Memory	FRAM	SDRAM

Use case of Memories in Router

Topics

New SPI FRAM operating at 125℃ being developed for automotive applications

Fujitsu Semiconductor's FRAM is widely used for power meters and office equipment and in the industrial equipment market. Although the FRAM currently being offered guarantees a maximum operating temperature of 85℃, Fujitsu is developing a new FRAM product for use in automobiles that has an extended operating temperature of up to 125℃, targeting the automotive applications.

This new product features not only a maximum operating temperature of 125℃, but also improved reliability achieved by reviewing the existing internal circuit design in order to meet high quality requirements from the automotive applications. Our automotive FRAM will conform to the AEC-Q100 (*1) reliability test criteria and also in compliance with PPAP (*2).

In response to current circumstances related to automotive applications, exhaust gas regulated, fuel efficiency, and safety equipment of motor vehicle have been complexly controlled by electronic devices inside the vehicle. The use of non-volatile memory featuring low power consumption, which retains data even when the power is turned off, is in an increasing trend in order to improve fuel efficiency. In addition, high reliability and excellent write performance of memory are essential in order to record important log data in memory in the event of a problem.

Fujitsu responds to these needs in the future automotive applications with our FRAM, high reliability and high performance non-volatile memory. For more information on our FRAM, please visit our FRAM website or contact our sales company.

*1: AEC (Automotive Electronic Council)
*2: PPAP (Production Part Approval Process)

Automotive device market requiring high reliability and high performance

What FRAM can do

FRAM, non-volatile memory, does not require a battery for data retention, and subsequently does not consume power to retain data. It also has an advantage in that it consumes less power for data writing as it requires less time to write data compared with standard EEPROM and Flash memory. Therefore, data can be written to FRAM with only very little generated power supply by energy harvesting, without a battery power supply. Fujitsu has actually verified that our demonstration device equipped with FRAM can write data without a battery.
In short, FRAM provides a batteryless solution by achieving low power consumption with its non-volatility and fast write speed.

● Recording the number of rotations only by rotating the dial without battery

iC-Haus GmbH, Fujitsu Semiconductor's business partner, provides a demonstration device equipped with FRAM and Wiegand wire technology. With this demonstration device, it is possible to confirm that data on the number of rotations of a dial can be written to FRAM with only generated power supply by rotating the dial. You can view a video showing a demonstration device in operation from our FRAM website.
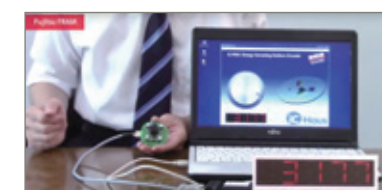
Demo made by iC-Haus using FRAM

● Recording the number of bent times only by bending flexible board without battery

Fujitsu has developed a demonstration device equipped with FRAM that uses a flexible board (91 mm × 55 mm as the size of a business card) made of a plastic piezoelectric device as the energy harvesting power supply provided by Munekata Co., Ltd (*1). With this device, you can confirm that FRAM can be written data of the bent time with only little generated power supply by bending flexible board.

*1: Munekata Co., Ltd. provides plastic piezoelectric devices using the spray coating method.

Demo using FRAM and Piezoelectric device

Standalone Memory

Serial Memory

Operating voltage of all those products is 3.3V now, however, Fujitsu has been developing 1.8V-operation FRAMs. Fujitsu can offer serial I/O FRAMs with 8-pin SOP packages for replacement of EEPROM, and also with SON (Small Outline Non-leaded package) and WL-CSP (Wafer Level Chip Size Package) for equipped in the wearable devices.
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.

● I²C 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°C	10 trillion 10^{13} times	10 years (+85°C)	SOP-8
MB85RC512T	512Kbit	1.8 to 3.6V	3.4MHz	-40 to +85°C	10 trillion 10^{13} times	10 years (+85°C)	SOP-8
MB85RC256V	256Kbit	2.7 to 5.5V	1MHz	-40 to +85°C	1 trillion 10^{12} times	10 years (+85°C)	SOP-8
MB85RC128A	128Kbit	2.7 to 3.6V	1MHz	-40 to +85°C	1 trillion 10^{12} times	10 years (+85°C)	SOP-8
MB85RC64TA	64Kbit	1.8 to 3.6V	3.4MHz	-40 to +85°C	10 trillion 10^{13} times	10 years (+85°C)	SOP-8/SON-8
MB85RC64A	64Kbit	2.7 to 3.6V	1MHz	-40 to +85°C	1 trillion 10^{12} times	10 years (+85°C)	SOP-8
MB85RC64V	64Kbit	3.0 to 5.5V	1MHz	-40 to +85°C	1 trillion 10^{12} times	10 years (+85°C)	SOP-8
MB85RC16	16Kbit	2.7 to 3.6V	1MHz	-40 to +85°C	1 trillion 10^{12} times	10 years (+85°C)	SOP-8/SON-8
MB85RC16V	16Kbit	3.0 to 5.5V	1MHz	-40 to +85°C	1 trillion 10^{12} times	10 years (+85°C)	SOP-8
MB85RC04V	4Kbit	3.0 to 5.5V	1MHz	-40 to +85°C	1 trillion 10^{12} times	10 years (+85°C)	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
MB85RQ4ML (*2)	4Mbit	1.7 to 1.95V	108MHz	-40 to +85°C	10 trillion 10^{13} times	10 years (+85°C)	SOP-16
MB85RS2MT	2Mbit	1.8 to 3.6V	25MHz (*3)	-40 to +85°C	10 trillion 10^{13} times	10 years (+85°C)	SOP-8/DIP-8
MB85RS1MT	1Mbit	1.8 to 3.6V	30MHz (*3)	-40 to +85°C	10 trillion 10^{13} times	10 years (+85°C)	SOP-8/WL-CSP-8
MB85RS512T	512Kbit	1.8 to 3.6V	30MHz (*3)	-40 to +85°C	10 trillion 10^{13} times	10 years (+85°C)	SOP-8
MB85RS256B	256Kbit	2.7 to 3.6V	33MHz	-40 to +85°C	1 trillion 10^{12} times	10 years (+85°C)	SOP-8
MB85RS128B	128Kbit	2.7 to 3.6V	33MHz	-40 to +85°C	1 trillion 10^{12} times	10 years (+85°C)	SOP-8
MB85RS64	64Kbit	2.7 to 3.6V	20MHz	-40 to +85°C	1 trillion 10^{12} times	10 years (+85°C)	SOP-8
MB85RS64V	64Kbit	3.0 to 5.5V	20MHz	-40 to +85°C	1 trillion 10^{12} times	10 years (+85°C)	SOP-8
MB85RS16	16Kbit	2.7 to 3.6V	20MHz	-40 to +85°C	1 trillion 10^{12} times	10 years (+85°C)	SOP-8
MB85RS16N	16Kbit	2.7 to 3.6V	20MHz	-40 to +95°C	1 trillion (+85°C) or 10 billion (+95°C)	10 years (+95°C)	SOP-8/SON-8
MB85RDP16LX (*4)	16Kbit	1.65 to 1.95V	15MHz (*5)	-40 to +105°C	10 trillion 10^{13} times	10 years (+105°C)	SON-8

*1: When operating temperature is lower than +85°C, data retention period can be extended. Please refer to datasheet.
*2: Both SPI and Quad SPI interfaces are available.
*3: Maximum 40MHz operation is available at fast read mode.
*4: With binary counter function
*5: Maximum 7.5MHz operation is available at Dual SPI mode.

Parallel Memory

For parallel interface FRAM from 256Kbit to 4Mbit are available with TSOP packages. 256Kbit FRAM with SOP package is also available. All of our parallel memories operate at 3.3V, except MB85R4M2T, which operates in a wide supply voltage range between 1.8V and 3.6V.
These products are suited for replacement of battery back-upped SRAM and applications of low power consumption devices.

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°C	10 trillion 10^{13} times	10 years (+85°C)	TSOP-44
MB85R4001A	4Mbit (512K×8)	3.0 to 3.6V	150ns	-40 to +85°C	1 trillion 10^{10} times	10 years (+55°C)	TSOP-48
MB85R4002A	4Mbit (256K×16)	3.0 to 3.6V	150ns	-40 to +85°C	1 trillion 10^{10} times	10 years (+55°C)	TSOP-48
MB85R1001A	1Mbit (128K×8)	3.0 to 3.6V	150ns	-40 to +85°C	1 trillion 10^{10} times	10 years (+55°C)	TSOP-48
MB85R1002A	1Mbit (64K×16)	3.0 to 3.6V	150ns	-40 to +85°C	1 trillion 10^{10} times	10 years (+55°C)	TSOP-48
MB85R256F	256Kbit (32K×8)	2.7 to 3.6V	150ns	-40 to +85°C	1 trillion 10^{12} times	10 years (+85°C)	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.

Package Size

● Serial Memory

Package	Top view	Width × Length (mm)	Height (mm)
WL-CSP-8		2.3 × 3.1	0.33
SON-8		2.0 × 3.0	0.7
SOP-8		3.9 × 5.1	1.75
SOP-16		7.5 × 10.3	2.7

*Regarding detailed package size, please refer to datasheet.

● Parallel Memory

Package	Top view	Width × Length (mm)	Height (mm)
SOP-28		7.6 × 17.8	2.8
TSOP-28		8.0 × 11.8	1.2
TSOP-44		10.2 × 18.4	1.2
TSOP-48		12.0 × 12.4	1.2

Online Store to Buy FRAM Samples

In response to requests from our customers to get a small number of FRAM samples for evaluation, our FRAM website has set up the "Buy via Online" button on our FRAM website. The button is linked to online shopping sites for electronic devices handling Fujitsu Semiconductor's FRAM products, where you can purchase FRAM products in SOP or TSOP packages via the Internet.
 (When you purchase FRAM products from external online shopping sites, please confirm and follow the policy and terms and conditions of each site.)
If you are unable to find the FRAM products you are looking for from online shopping sites, please contact our sales company or us directly. Please visit Fujitsu Semiconductor's website to find the contact information for our sales companies and the inquiry form.

Buy via Online

Icon on FRAM website

For more information, please visit: FRAM   Search

FRAM-embedded LSI

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

FRAM-embedded RFID LSI

By using the unique features of FRAM, Fujitsu provides FRAM-embedded RFID LSI with a wireless interface. Our products are not simply read-oriented RFID tags. They are being increasingly adopted for use in data carrier RFID tags in the fields of factory automation (FA) in which needs to often rewrite production and maintenance records. These products are attracting attention as LSI to support the sensor networking society whose future depends on wireless communication of data acquired by sensors.

● **Features**
- Improves throughput with faster write speeds
- Due to the low power consumption, there is no degradation due to communication 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 (mode 1), 6

● **Lineup**

Operating frequency	Communication distance (MAX)	Memory density		
		36byte to 256byte	2Kbyte	8Kbyte to 9Kbyte
UHF band 860-960MHz	3m	MB97R8050 • FRAM 36B (EPC 128bit)	–	MB97Rxxxx • FRAM 8KB • SPI I/F
HF band 13.56MHz	50cm	MB89R119B • FRAM 256B	MB89R118C • FRAM 2KB	MB89R112A • FRAM 9KB • SPI I/F

Part number	Operating frequency	Memory density	Commands	Serial interface	Data retention	Read/Write cycles
MB97Rxxxx (*1) (developing)	UHF 860-960MHz	8KByte	ISO/IEC18000-63 EPC C1G2 Ver.1.2.0	SPI	10 years (+55˚C)	10 billion 10^{10} times
MB97R803A (EOL product)	UHF 860-960MHz	4KByte	ISO/IEC18000-63 EPC C1G2 Ver.1.2.0	–	10 years (+55˚C)	10 billion 10^{10} times
MB97R804B (EOL product)	UHF 860-960MHz	4KByte	ISO/IEC18000-63 EPC C1G2 Ver.1.2.0	SPI	10 years (+55˚C)	10 billion 10^{10} times
MB97R8050	UHF 860-960MHz	36Byte (EPC128bit)	ISO/IEC18000-63 EPC C1G2 Ver.1.2.0	–	10 years (+55˚C)	10 billion 10^{10} times
MB89R118C	HF 13.56MHz	2KByte	ISO/IEC15693	–	10 years (+85˚C)	1 trillion 10^{12} times
MB89R119B	HF 13.56MHz	256Byte	ISO/IEC15693	–	10 years (+85˚C)	1 trillion 10^{12} times
MB89R112A	HF 13.56MHz	9KByte	ISO/IEC15693	SPI	10 years (+85˚C)	1 trillion 10^{12} times

*1: MB97Rxxxx (developing) is subsequent product to MB97R803A/804B.

● **Applications suited for RFID LSI**

Factory
- Process record
- Data-log

Medical
- Use history record
- Information check

Logistics
- Transportation record
- Product control

Transportation
- Maintenance record

Inventory Control
- Loading history
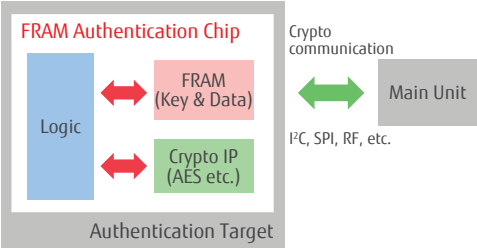- Environment record

Infrastructure
- Maintenance record
- Monitoring

FRAM-embedded Authentication LSI

FRAM products have rich experiences in using for security applications such as IC cards. Fujitsu Semiconductor provides FRAM-embedded Authentication LSI and MB94R330 is one of standard product as the authentication LSI.

Part number	Supply voltage	Interface	Communication frequency	Operating temperature	Read/Write cycles	Package
MB94R330	3.0 to 3.6V	I^2C	400kHz	-20 to +85˚C	10^{12} (1 trillion) times	SON-8

Through the Challenge and Response authentication between the electric equipment and the peripheral, the MB94R330's sequence identifies between authorized and unauthorized parts.
MB94R330 is suitable for detecting cloned peripherals and accessories (cartridges, toners, etc.) that are used in electronic equipment such as printers, multifunction printers, etc.
For security applications, Fujitsu provides custom LSIs in addition to MB94R330 of standard authentication LSI to meet the specific individual specification requirements of each customer.

FRAM Authentication Chip
Logic
FRAM (Key & Data)
Crypto IP (AES etc.)
Authentication Target
Crypto communication
Main Unit
I^2C, SPI, RF, etc.

Example of using authentication LSI

Proof of High Technology

Development of FRAM began in 1995, and Fujitsu has a track record of more than 17 years of mass production. Continuous mass production and stable supply of FRAM is evidence of Fujitsu Semiconductor's advanced technological skills.

Initially FRAM using ferroelectric technology could not be mass produced because ferroelectric deteriorated through conventional semiconductor processes. Fujitsu identified the cause of the deterioration and adopted a countermeasure to the manufacturing process, which led to us being the first company to successfully mass produce FRAM.
The development of mass production technology for FRAM products and their contributions to society were honored in prizes recent years. Fujitsu continues stable supply of high quality FRAM backed by our technological strength.

History of awarded prize
■ 2013: • The 7th Japan Society of Applied Physics (JSAP) Fellow Award
• The 61th Electrical Science and Engineering Promotion Award and the Promotion Award by the Minister of Education, Culture, Sports, Science and Technology
■ 2014: • The 60th Okouchi Memorial Technology Prize
• The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, the Prizes for Science and Technology
• The 14th Yamazaki-Teiichi Prize
■ 2015: • Medals of Honor in Spring of 2015, Medal with Purple Ribbon

Winning of Yamazaki-Teiichi Prize

Sales Company for FRAM

Fujitsu Semiconductor's sales companies are Fujitsu Electronics Inc. and its contracting distributors. Please contact Fujitsu Electronics or its sales office near you for any requests or inquiries regarding FRAM products.
Fujitsu Electronics also has sales offices overseas, allowing it to provide seamless support to customers expanding their operations overseas. You can also find contact information on the sales offices of Fujitsu Electronics in Japan and overseas from the link provided on Fujitsu Semiconductor's website.

■ Corporate Name: Fujitsu Electronics Inc.
Head Office: Shin-Yokohama Chuo Bldg., 2-100-45, Shin-Yokohama, Kohoku-ku, Yokohama, Kanagawa, 222-8508 Japan
URL: http://www.fujitsu.com/jp/group/fei/en

Global Contacts

Icon on FRAM website

Capable to support customers globally

Sales Offices in worldwide