

FRAM®-Embedded Large-Capacity, High-Speed RFID LSI

FerVID Family™

MB89R118

MB89R118 is a large-capacity, high-speed RFID LSI and compliance with the international standard, ISO/IEC15693, to make the most of the efficiency. It is embedded with FRAM which can write the data twice as fast as conventional device and it has large-capacity 2Kbytes memory size.

Overview

RFID tags^{*1} have begun to replace conventional barcode tags and are now widely used for many purposes, with their advantageous large memory size.

FUJITSU has developed MB89R118, a large-capacity, high-speed RFID LSI that is compliance with the international standard, ISO/IEC15693^{*2}. This product is a high-performance version of our RFID LSI MB89R116, realizing much faster reading/writing the data adding custom fast commands. Communication distance has been also improved through the reduction of power consumption. In addition, it has an anticollision function. So MB89R118 will be best suited for applications of distributed data processing with the various data itself, such as SCM, logistics, retail systems, recycle systems, and quality control.

Product Features

Table 1 presents the main specifications of this product.

■ Large-capacity memory

MB89R118 has large capacity 2Kbytes memory which exceeds

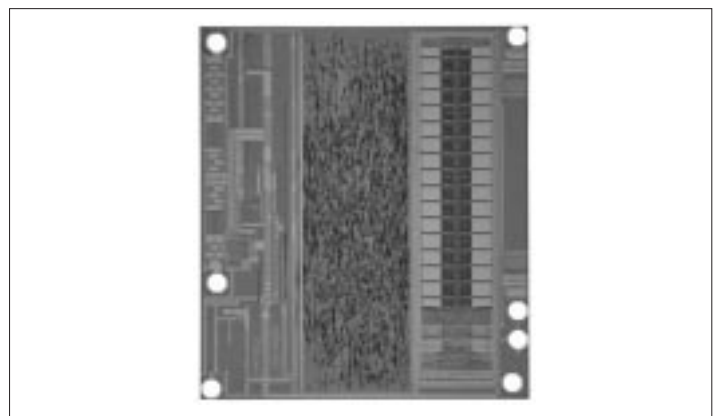
that of any other RFID LSI.

While RFID LSI is generally capable of reading/writing data of 64 to 256 characters, MB89R118 is capable of reading/writing data of 2,000 characters. Thus, it can add the data as needed during the circulation process and enables thorough quality control.

■ FRAM-embedded memory

This product is embedded with FRAM, a nonvolatile memory.

Photo 1 External View of Chip



Therefore, its data retention time is as long as 10 years and it has an extremely high programming cycle (10¹⁰ cycles) compared to other nonvolatile memories.

Furthermore, it supports a wide range of temperatures; Operating temperature is at -20°C to 85°C, and storage temperature is at -40°C to 85°C, enabling quality control and product control under severe environmental conditions.

High-speed memory access/high-speed data processing

In this product the programming cycle to the internal memory FRAM is 75.52μs/block (8bytes). MB89R118 is embedded with FRAM memory, so the writing time which was previously the bottleneck for conventional nonvolatile memories can be shorted sharply.

It is possible to read/write data to two blocks (16bytes) at one time with Read Multiple Blocks/Write Multiple Blocks Commands. Moreover, one of our custom commands (Read Multiple Blocks Unlimited Commands) enables the successive reading of a maximum of 256 blocks (2,048bytes) to meet the demand for the reading of large-volume data with faster speed.

In addition, the Fast Commands, which are the new functions of this product, realize high-speed processing in a half by shortening the response time from MB89R118 to the reader/writer.

* Examples of reading/writing time of 2,000bytes data:

Data reading by Read Multiple Blocks Commands (with UID specified): 1.5sec

Data writing by Write Multiple Blocks Commands (with UID specified): 1.4sec

Data reading by Fast Read Multiple Blocks Unlimited Commands (with UID specified): 0.35sec

FRAM data protection

This product accesses (writes) to FRAM in byte unit. Writing into each byte is carried out after ensuring that there is sufficient of power supply-voltage in every writing. If RF power is lost during access, MB89R118 detects a lowering of the power-supply voltage. After the detection, MB89R118 continues to write operation with electric charge stored smoothing capacitor. So we don't lose the data, if the power supply shuts down during writing operation.

Memory Configuration

Table 2 presents the memory map of this product.

This product contains 8bytes per block. All read/write (lock) commands perform in block units. The user area occupies 2,000bytes from block 00H to block F9H. The remaining 48bytes comprise the system area. It includes the following system information:

Table 1 Main Specifications

Item	Nominal parameter
Memory size	2,048bytes
User memory size	2,000bytes
Operation frequency	13.56MHz
Data retention time	10 years at 55°C
Programming cycle	10 ¹⁰ cycles
Operation temperature	-20°C to 85°C
Storage temperature	-40°C to 85°C
Input capacity between antennas	24pF
Power consumption	20 μW

Table 2 Memory Map

Area	Block no.	Description
User area (2,000bytes)	00H	User area
	01H	User area
	⋮	⋮
	F9H	User area
	FAH	UID
System area (48bytes)	FBH	EAS, AFI, DSFID, Security status
	FCH	Block security status
	⋮	⋮
	FFH	Block security status

- **UID (Unique Identifier):** A serial number unique to each LSI that includes information such as a manufacturer code. Uses 8bytes.
- **AFI (Application Family Identifier):** The application type of the RFID LSI, such as “transportation”, “finance”, or “individual authorization”.
- **DSFID (Data Storage Format Identifier):** The information for data configuration in memory.
- **Security Status:** Defines whether each data of AFI or DSFID is in Lock (write protection) status or not.
- **Block Security Status:** Defines whether each data stored in the user area is in Lock (write protection) status or not.
- **EAS Status:** Defines whether the RFID LSI is in the product control status or not.

Commands

Table 3 lists the commands of this product. MB89R118 supports all Mandatory commands and Optional commands of the international standard, ISO/IEC15693. Custom commands are our original commands.

Inventory command

This is the command to execute the anticollision sequence and get UID. We can select two modes with this command. SLOT1 mode enables to get UID for a single tag, SLOT16 mode enables to get UID for multiple tags.

Stay Quiet command

This is the command to set the tag to Quiet (communication disabled) status. If we want to return Ready (communication enabled) status in this tag, it receives a Reset to Ready command or power supply of it turns off and returns on again.

Read Single Block command

This is the command to read the data for the specified 1 block in the user area.

Write Single Block command

This is the command to write the data into the specified 1 block in the user area.

Lock Block command

This is the command to set Lock (write protection) status specified 1 block in the user area.

Read Multiple Blocks command

This is the command to read the data from the specified 1 or 2 blocks in the user area.

Write Multiple Blocks command

This is the command to write the data into the specified 1 or 2 blocks in the user area.

Select command

This is the command to set the tag to Select (selected UID communication) status. If this command is received, MB89R118 returns the responses, only when the UID matches.

Reset to Ready command

This is the command to set the tag to Ready (communication enabled) status.

Write (Lock) AFI command

The Write AFI command is the command to write the data into AFI of MB89R118. We can specify which application we want to use with this command. (If Inventory command is sent with AFI data and the AFI data of MB89R118 is different from that of Inventory command, MB89R118 don't return the

Figure 1 Applications

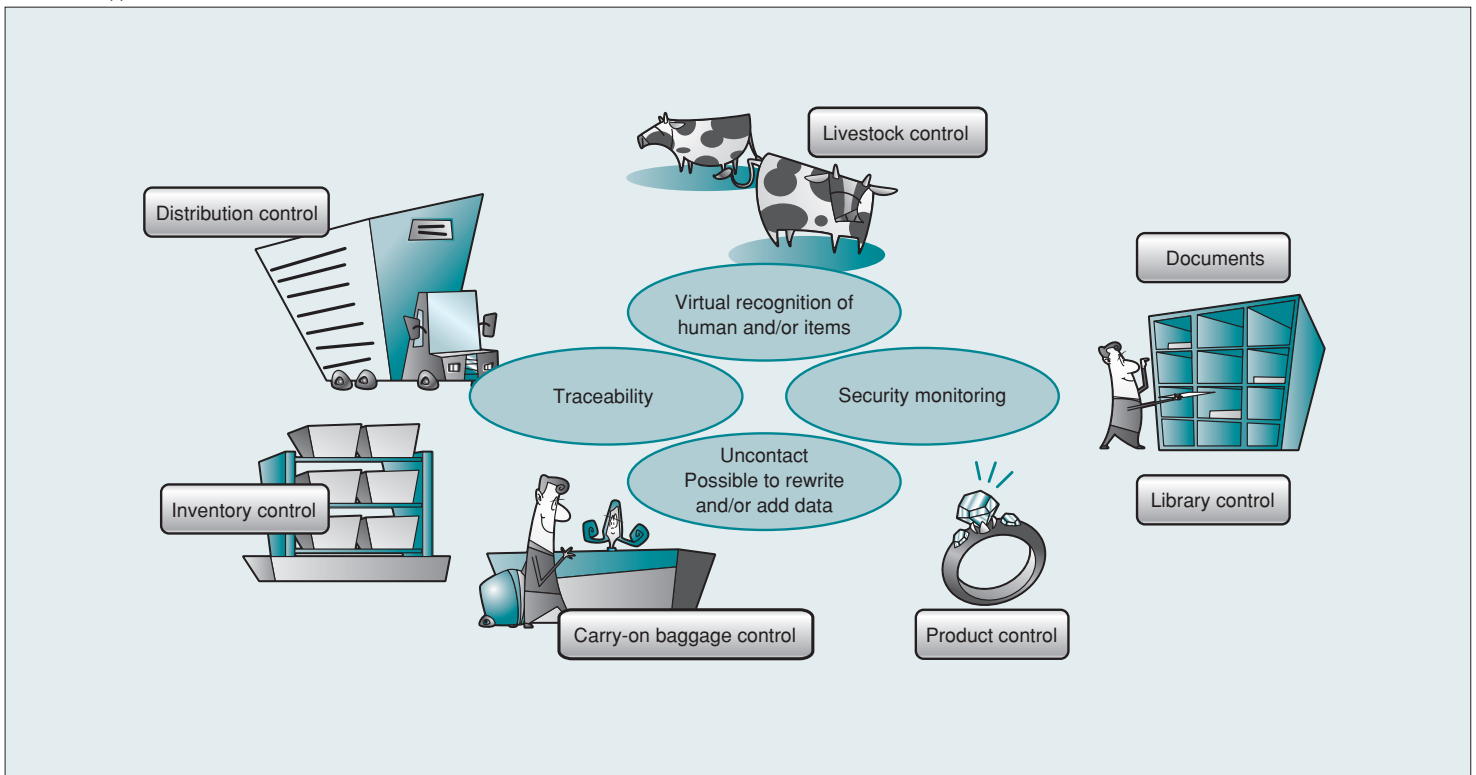


Table 3 Commands

Command type	Command
Mandatory	Inventory
Mandatory	Stay Quiet
Optional	Read Single Block
Optional	Write Single Block
Optional	Lock Block
Optional	Read Multiple Blocks
Optional	Write Multiple Blocks
Optional	Select
Optional	Reset to Ready
Optional	Write AFI
Optional	Lock AFI
Optional	Write DSFID
Optional	Lock DSFID
Optional	Get System Information
Optional	Get Multiple Block Security Status
Custom	EAS
Custom	Write EAS
Custom	Read Multiple Blocks Unlimited
Custom	Fast Inventory
Custom	Fast Read Single Block
Custom	Fast Write Single Block
Custom	Fast Read Multiple Blocks
Custom	Fast Write Multiple Blocks
Custom	Fast Write EAS
Custom	Fast Read Multiple Blocks Unlimited

response.) The Lock AFI command is the command to set AFI to Lock (write protection) status.

Write (Lock) DSFID command

The Write DSFID command is the command to write the data into DSFID of MB89R118. In addition, the Lock DSFID command is the command to set DSFID to Lock (write protection) status.

Get System Information command

This is the command to read IC information, such as UID, AFI, DSFID, the number of bytes stored in 1 Block and the number of blocks stored in user area.

Get Multiple Block Security command

This is the command to read the data of Block Security Status in the system area. We can know whether the block specified this command is Lock (write protection) status or not.

EAS command

This is our original command; to be for theft prevention. MB89R118 returns a response only when the EAS bit is set to “1”.

Write EAS command

This is our original command to write the data into EAS bit consisting of one bit. When data is “0”, the theft prevention and product control status are cancelled so that MB89R118 do not return a response to the EAS command. When data is “1”, it is theft prevention and product control status so that MB89R118 will return response to the EAS command.

Read Multiple Blocks Unlimited command

This is our original command to read the data from multiple blocks (256 blocks maximum) in the FRAM memory.

Fast Inventory command

This is our original Inventory command to enable to return the response faster.

Fast Read Single Block command

This is our original Read Single Block command to enable to return the response faster.

Fast Write Single Block command

This is our original Write Single Block command to enable to return the response faster.

Fast Read Multiple Blocks command

This is our original Read Multiple Block command to enable to return the response faster.

Fast Write Single Block command

This is our original Write Single Block command to enable to return the response faster.

Fast Write EAS command

This is our original EAS command to enable to return the response faster.

Fast Read Multiple Blocks Unlimited command

This is our original Read Multiple Blocks Unlimited command to enable to return the response faster.

Future Development

Fig.2 shows the roadmap of our RFID LSIs.

As succeeding products, FUJITSU plans to release two types of RFID LSIs, one of which uses the 13.56MHz band and the other uses the UHF band. As a 13.56MHz-band product, we plan to release a small-capacity LSI embedded 256-byte FRAM memory. This product adopts the theft prevention function (EAS command) and write protection function(Lock command) for security purposes, the same as MB89R118. Its engineering sample (ES) version will be released in April 2005.

We plan two types of UHF-band products. One is a 1Kbyte-

memory product targeting applications for carry-on baggage on airlines and delivery services and the other is a standard product supported specifications of Auto-ID Labs and the Ubiquitous ID Center.

FUJITSU will continue to develop and supply products to meet customer needs. *

NOTES

*1: RFID tag: A wireless ID recognition system that is also called “IC tag” or “wireless tag”.

*2: International standard ISO/IEC15693: One of the international standard for vicinity-type contactless IC tags. It is applied to systems with a communication distance of 10 to 70cm. The frequency uses 13.56MHz.

Some of the specifications of MB89R118 do not support for the ISO/IEC15693 standard:

- Communication method: Supports ASK 10% only.
- Data coding: Supports 1 out of 4 modes only.
- Subcarrier: Supports 1 subcarrier only.

In some cases, a change of settings is needed for using ISO/IEC15693-compliant readers. Please ask for details.

* FRAM is a registered trademark of Ramtron International Corporation.

* FerVID family is a trademark of FUJITSU LIMITED.

Figure 2 Roadmap for FRAM-Embedded RFID LSI

