

FRAM[®]-Mounted High-Capacity, High-Speed LSI for RFID Tag **MB89R116**

A high-capacity, high-speed LSI for an RFID tag that conforms to the international standard, ISO/IEC15693. Capable of reading/writing the data of the maximum 2,000 characters with 1.5sec. read time and 1.4sec. write time.

Wide range of supported temperatures for use and storage, and quality/product control is possible under severe environmental conditions.

Overview

Recently, RFID tags^{*1} are expected to replace conventional barcode tags due to their advantageous large memory size, read-speed rate, durability, and environmental resistance.

FUJITSU has already developed “MB89R116,” a high-capacity, high-speed LSI for RFID tags that conforms to the international standard, ISO/IEC15693^{*2}. This product offers small size and low cost while providing high-capacity. This enables the provision of high-quality products and services with high additional values in various fields including circulation, distribution, and quality control.

Product Features

Table 1 shows the main specifications of this product; **Table 2** its application examples; and **Fig.1** its expected applications in various fields.

■ High-capacity memory

In this product, a high-capacity consisting of a 2Kbytes memory size which has 2,000bytes user area, which exceeds that of any other LSI for RFID tags, has been achieved.

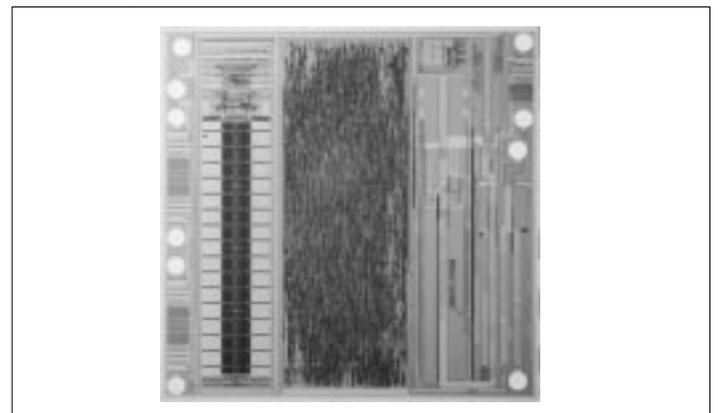
While conventional RFID tags are capable of reading/writing

the data of 24 to 256 characters, this product is capable of reading/writing the data of 2,000 characters. Thus it allows data to be added as needed during the circulation process and enables thorough quality control.

■ FRAM-mounted memory

This product is mounted with FRAM, a nonvolatile memory. Therefore, its data retention time is as long as 10 years (at 55°C), and it has extremely high data rewriting times at 10¹⁰

Photo 1 Chip



cycles compared to other nonvolatile memories.

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

■ High-speed memory access/high-speed data writing

This product has a short access time of $75.52\mu\text{s}/\text{block}$ to the internal memory FRAM, and it is capable of accessing to FRAM memory faster than those of other nonvolatile memories. In addition, it has a read time of 1.5sec. and a write time of 1.4sec.^{*3} for all user areas (2,000bytes), resulting in writing time that is about two times faster than other nonvolatile memories. This leads to reduced data writing time during product control by decreasing the writing time between the reader/writer and the IC tag, which was previously the bottleneck of the high-capacity RFID tag.

■ Memory data protection

This product accesses (writes) to FRAM by each byte. Writing into each byte is carried out after ensuring that there

is sufficient power supply voltage every writing area. If RF power is cut off during access, a lowering of the power supply voltage is detected. Writing operations occurring before detection, automatically performed by the electric charge accumulated in the smooth capacitance of this product, thus preventing the miswriting of FRAM data.

Memory Configuration

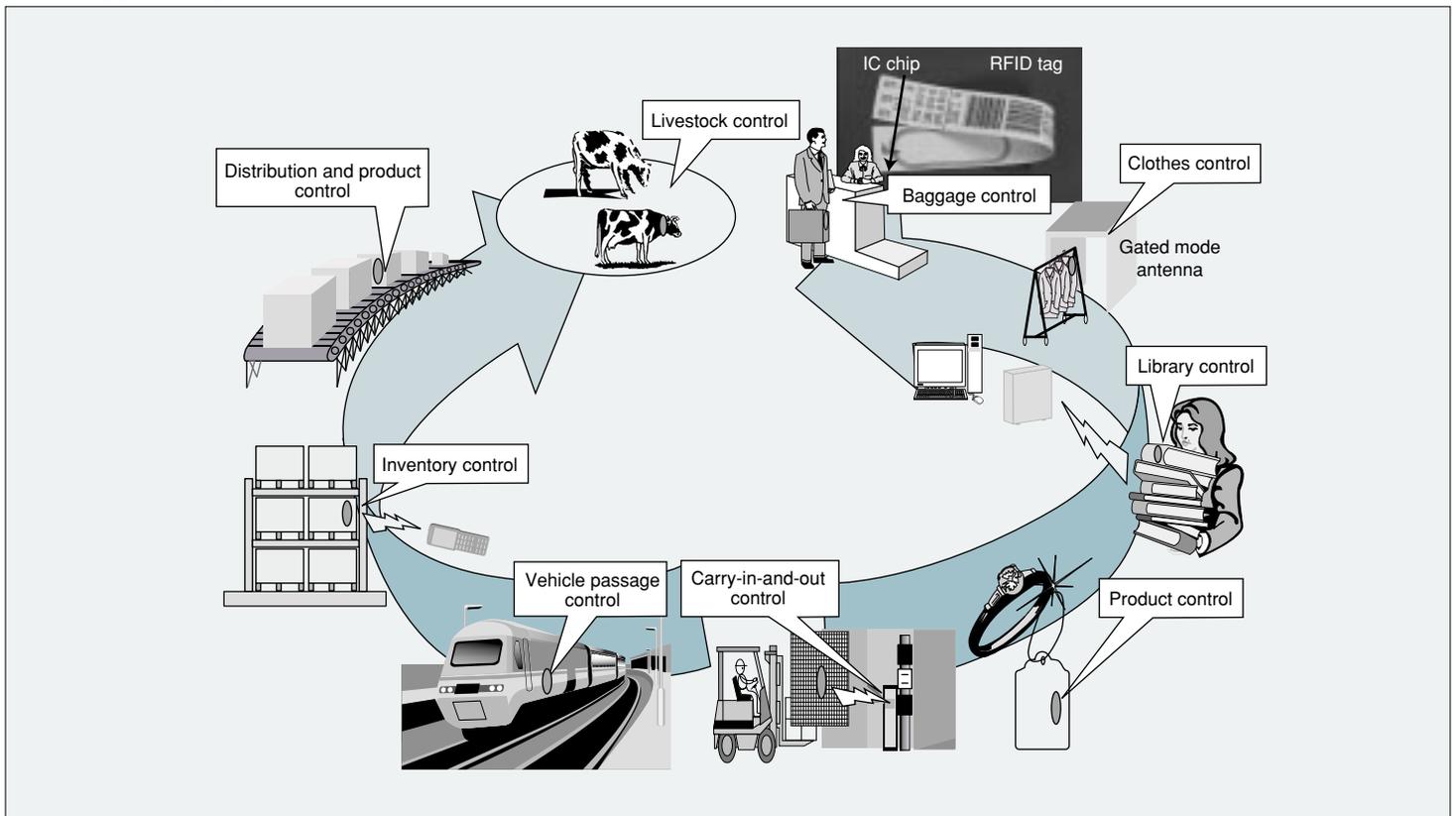
Table 3 shows the memory area of this product.

This product contains 8bytes per block. All read/write commands are provided in block units. The user area occupies 2,000bytes from block 00H to block F9H. The remaining 48bytes consist of the system area.

It includes system information as follows:

- UID (Unique Identifier)
The information on unique numbers, such as a manufacturer code
- AFI (Application Family Identifier)
The information of application

Figure 1 Applications expected in each field



- DSFID (Data Storage Format Identifier)
The information for data configuration in memory
- Security Status
- Block Security Status

Commands

Table 4 shows the commands of this product.

Among the commands of this product, Mandatory commands and Optional commands conform to the international standard, ISO/IEC15693. Custom commands are our original commands.

Inventory command

This is the command to execute the anti-collision sequence and obtain UID. With this command, SLOT1 for obtaining the UID for a single tag or SLOT16 for obtaining UID for plurality tags can be selected.

Stay Quiet command

This is the command to set the tag to Quiet (communication-disabled) status.

Read Single Block command

This is the command to read out the data for the specified 1 block.

Write Single Block command

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

Lock Block command

This command sets the specified 1 block to Lock (writing-disabled) status.

Read Multiple Blocks command

This is the command to read out data from the specified 1 block or 2 blocks.

Write Multiple Blocks command

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

Select command

This is the command to set the tag to Select (selected communication) status. When this command is received, communication becomes possible when the UID matches.

Table 1 Specifications

Item	Specification
Memory size	2048 bytes
User memory size	2000 bytes
Operation frequency	13.56MHz
Data retention period	10 years at 55°C
Times of data rewriting	10 ¹⁰ cycles
Circumferential temperature for use	-20°C to 85°C
Circumferential use for storage	-40°C to 85°C
Input capacity between antennas	24pF

Table 2 Application Examples

Distribution Transport	Chassis/container/palette collection, efficient inspection, vehicle passage control, aircraft carry-on baggage control, package delivery
Circulation	Product inventory, order reception control
FA	Part manufacture history control, quality control
Rental/lease	Customer control, product control
Home appliances	Recycling, product control
Industry	Process control, product control

Table 3 Memory Space

Area	Block no.	MSB	LSB
		64	1
User area (2000bytes)	00H	User area	
	01H	User area	
	⋮	⋮	
	F9H	User area	
	S0	UID	
System area (48bytes)	S1	AFI, DSFID, Security status	
	S2	Block security status	
	⋮	⋮	
	S5	Block security status	

■ 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 writes data into AFI. It is possible to specify the purpose for which the RFID tag and R/W are used. In addition, the Lock AFI command sets the AFI to a status in which data writing is disabled.

■ Write (Lock) DSFID command

The write DSFID command writes data into DSFID. In addition, the Lock DSFID command sets DSFID to a status in which data writing is disabled.

■ Get System Information command

The data of UID, DSFID, AFI, the number of bytes that can be stored in 1 block, the number of blocks contained in 1 chip, IC information, and system information are read.

■ Get Multiple Block Security Status command

This command reads the block security status data stored in the system area and reads the data to determine whether or not the corresponding block is locked.

■ EAS command

This is our original command; it is for theft prevention.

■ Write EAS command

This is our original command, and it writes data into EAS. It consists of 1-bit-theft prevention and product control are cancelled when data is “0,” and product control status is set when data is “1.”

■ Refresh command

This is our original command that accesses the entire FRAM area to update the stored data. It is used for maintenance of stored data.

■ Read Multiple Blocks Unlimited command

This is our original command that is used to read data from plurality blocks.

Future Development

Fig. 2 shows the roadmap of our RFID tags.

As succeeding products of this product, FUJITSU plans to release “MB89Rxxx”, a miniaturized version of “MB89R116”

conforming to the ISO/IEC15693 international standard, and the low capacity and low cost “MB89Ryyy.”

Moreover, the provision of a development evaluation kit that includes the “MB89R116”-mounted card-type tag, reader/writer, and demonstration software is planned.

FUJITSU will continue to develop and supply products to meet customers’ 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 programs for noncontact IC tags. It is applied to systems with a communication distance of 10 to 70cm. In addition, the frequency supports 13.56MHz.

*3: Read time of 1.5sec. and write time of 1.4sec. are the values when the Read Multiple Blocks command or the Write Multiple Blocks command is used. When the Read Multiple Blocks Unlimited command is used, reading the data is possible in a shorter period.

* FRAM is a registered product of American Ramtron International Corporation.

Table 4 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	Refresh
Custom	Read Multiple Blocks Unlimited

Figure 2 Roadmap of RFID Tag

