FRAM Embedded High Speed RFID LSI
FerVID family™ MB89R119

MB89R119 is RFID[*1] LSI and compliant with the international standard ISO/IEC15693[*2]. It embeds nonvolatile memory, FRAM 256bytes, and realizes high-speed, high-quality and low-cost. We introduce MB89R119 for the RFID market with MB89R118, embedded 2KB FRAM (in mass production).

Overview

RFID tags have several advantages, such as contactless rewritable, reusable, and resistant to severe environment compared with existing bar codes. So that RFID is expected to be used in advanced information systems and rapidly expanded to various applications.

FUJITSU has developed FerVID family "MB89R119", embedded 256bytes FRAM, for RFID LSI. It is compliant with the international standard ISO/IEC15693. MB89R119 is a small memory size version of "MB89R118" embedded FRAM 2KB. Because of the fast writing features of FRAM, these products realize high-speed and high-quality communication performance.

Product Features

Fig.1 shows the expected applications in various fields.

■ FRAM embedded memory
This product embeds nonvolatile memory FRAM. It is guaranteed that the data retention time is 10 years and the endurance is 10^{10} cycles, which is 10^5 times higher than the EEPROM embedded products.

This product also supports a wide range of temperatures with the operating temperature $-20°C$ to $85°C$ and storage temperature $-40°C$ to $85°C$. Quality/product control is possible even under severe environmental conditions.

■ High-speed memory access, high-speed data writing
This product has a fast access time of $37.8\mu s$/block to FRAM, which is faster than EEPROM. This feature enables to complete writing operation quickly enough to avoid any influence from the external magnetic field strength and realizes reliable communication.

Furthermore, the time to read all user area data (232bytes) is 74ms, and the time to write is 249ms[*3]. It is possible to write data approximately twice as fast as other nonvolatile

Photo 1 External View
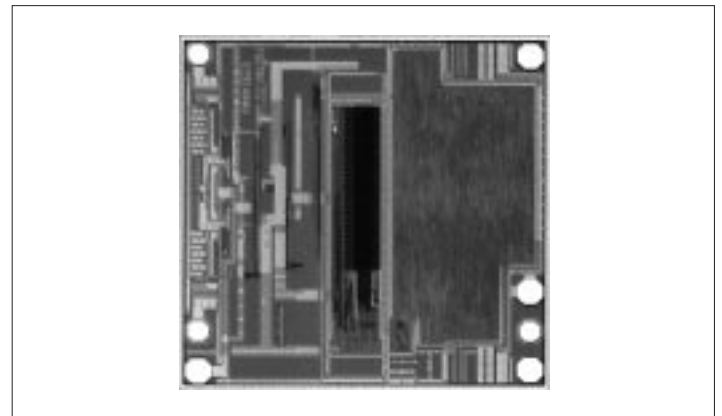
memories. As an example, reduction of writing time is effective in issuance of RFID tag. Writing process of RFID tags in a short period improves the issuance throughput and tag cost reduction.

■ Our original commands

This product supports the following original commands in addition to the ISO/IEC15693 commands:

● EAS (Electronic Article Surveillance) command

This is a command for theft prevention. A response is returned when it is in product control status. This improves product security.

● Fast command

This is a high-speed communication command in a half response time. Especially in reading large size data, the communication time reduced to one-half to one-third of the normal communication time.

● Kill command

This is a command to disable communication permanently. When this command is received, not only data writing but all commands including data reading are no longer accepted. This reduces security concern such as data peeking.

■ Memory data protection

In MB89R119, the transmitted data is accessed to FRAM with unit of one byte. Writing each byte data carries out after recognizing sufficient power supply voltage. If power is shut down while the data is being accessed to FRAM, drop in supply voltage is recognized. In the case of RF power shut down during access, writing in FRAM is completed by the charges stored in a smoothing capacitor on MB89R119 and FRAM data is prevented.

■ ucode tag certification

Following "MB89R118", this product was certified for ucode tag by the Ubiquitous ID Center (http://www.uidcenter.org/) on July 7, 2005 (certification number 01-008, category 1, class 1).

Memory configuration

Table 1 shows the memory map of this product.

Each block is organized 4bytes. The minimum unit for the data reading, data writing and data locking (disable to write) is defined as the block unit. Furthermore, we can read up to 64

Figure 1 Expected Applications in Various Fields
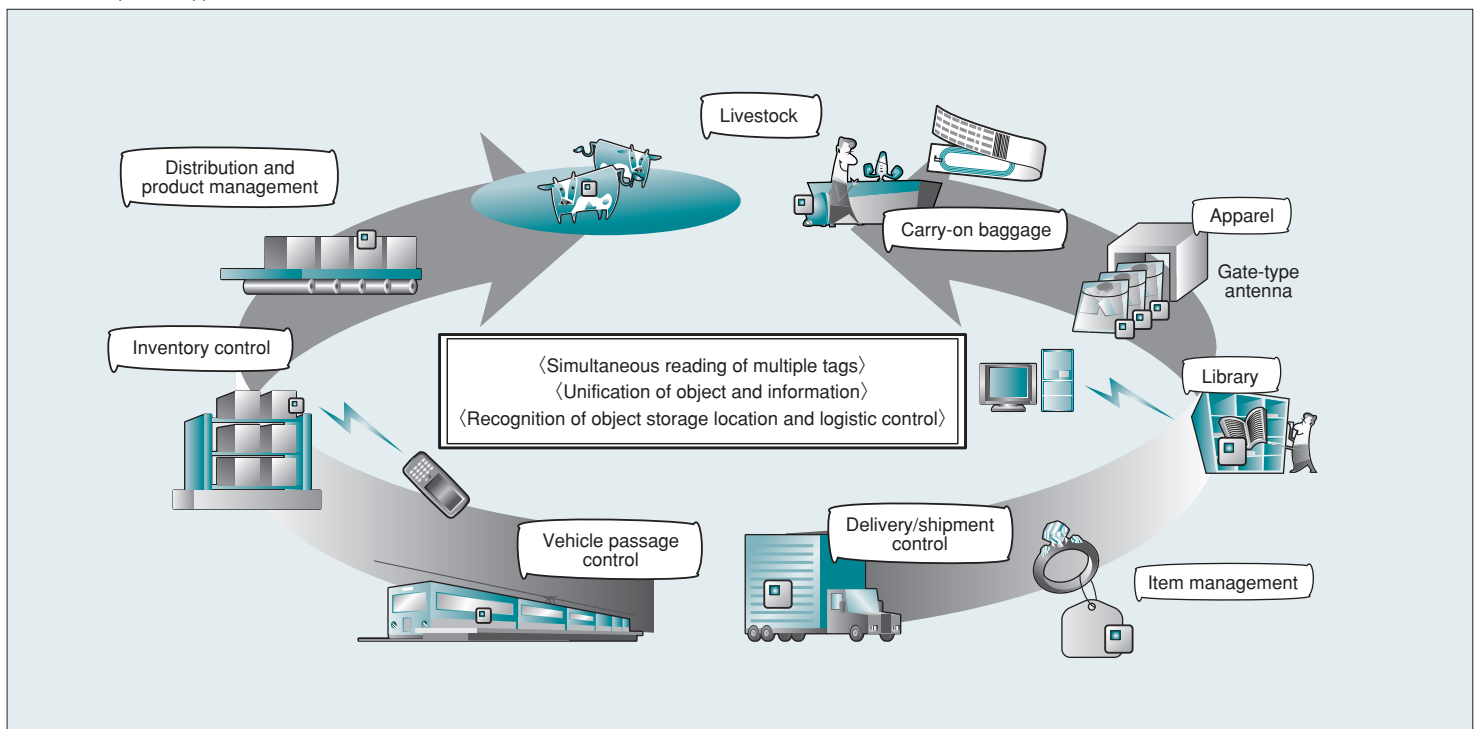
blocks data, write up to 2 blocks data and lock up to 1 block data by using 1 command.

Future development

Fig.2 shows FUJITSU's roadmap of RFID, and **Table 2** shows its lineup of RFID products.

MB89R118, embedded a large 2KB memory, is another product compliant with ISO/IEC15693 (supporting 13.56MHz) —it is already in mass production. In addition, MB89R111, a product supporting ISO/IEC14443 Type B (supporting 13.56MHz), featuring a high-speed data rate of 106Kbps/212Kbps, is also in mass production.

In concurrence with the version of the ordinance by the Ministry of Internal Affairs and Communication in April of this year, FUJITSU is developing two types of RFID LSI adopting a UHF band. We continue to provide products widely in a timely manner to our customer needs. ✱

NOTES

✱1: RFID: Abbreviation for R̲adio F̲requency I̲dentification. A system utilized to make an identification of a person or an object by writing or reading data in a card-type or tag-type medium with a built-in IC using radio waves.

✱2: International standard ISO/IEC15693: One of the international standard for contactless IC tags. It is applied to system with communication distances of about 10 to 70cm; the frequency corresponds to 13.56MHz. Please note that our chip does not conform to the standard in the following items:
- Subcarrier: 2-subcarrier "FSK" (MB89R119 supports only 1-subcarrier)
- Data coding: 1 out of 256 modes(MB89R119 supports only 1 out of 4 modes)

✱3: Reading time 74ms, writing time 249ms: Time when Read Multiple Blocks command or Write Multiple Blocks command is used.

✱ FerVID family is a trademark of FUJITSU LIMITED.

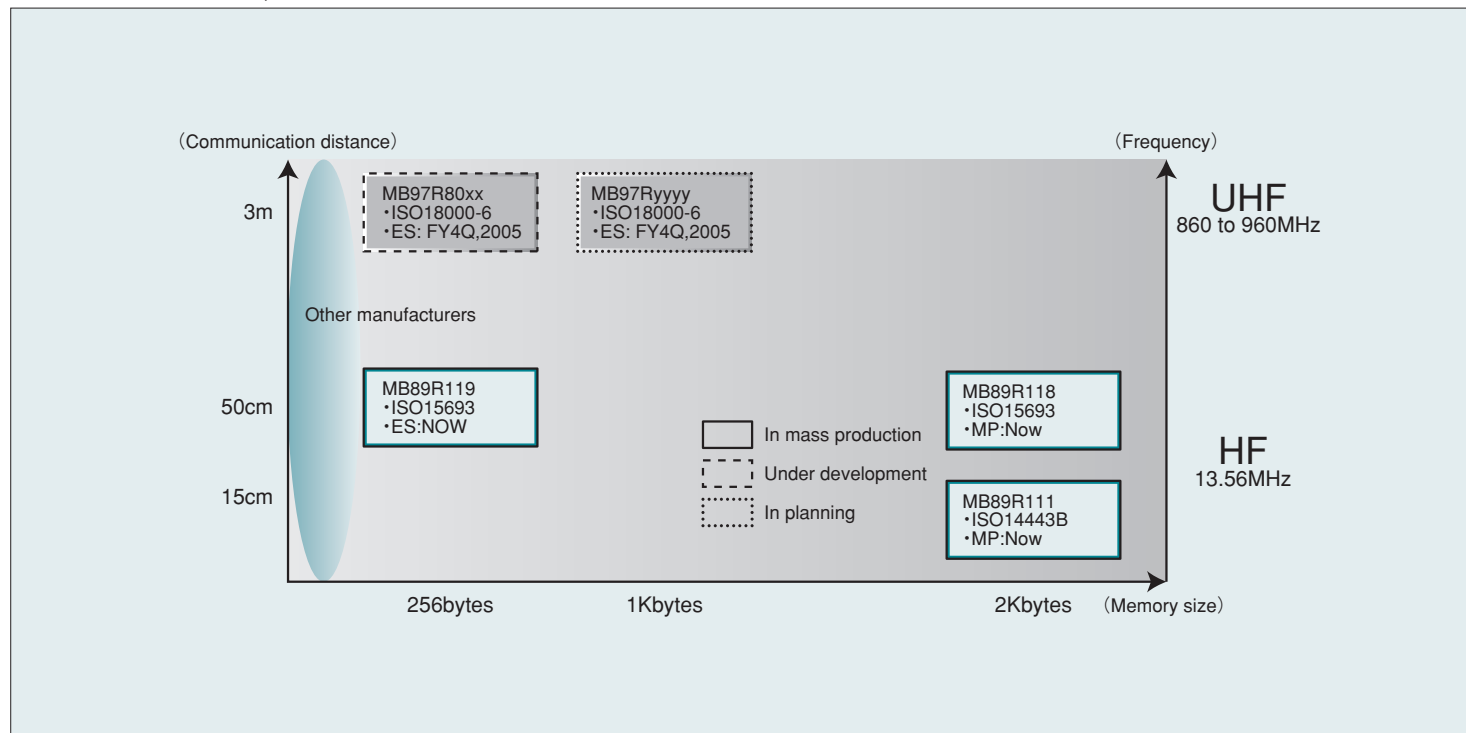**Figure 2** FUJITSU's Roadmap of RFID

Table 1 Memory Map for this Product

Area	Block number	Details	Data read		Data write	
			Read command	Command capable of data reading	Write command	Command capable of data writing
User area (232bytes)	00H to 39H	User area	○	——	○	——
System area (24bytes)	3AH	RFU（Reserved for Future Use）	○	×	×	×
	3BH, 3CH	UID	○	Inventory command Get System Information command	×	×
	3DH	AFI, DSFID, EAS status IC Reference, system data	○	Get System Information command (only for AFI, DSFID, and IC Reference)	×	Write AFI command Write DSFID command Write EAS command
	3EH, 3FH	Block security status Security status	○	×	×	×

・UID (Unique Identifier): A serial unique number included information such as a manufacturer code. Uses 8bytes.
・AFI (Application Family Identifier): Information on RFID application, such as "transportation," "finance," or "individual authorization."
・DSFID (Data Storage Format Identifier): Information on 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.

Table 2 Lineup of FUJITSU RFID Products

	MB89R111	MB89R118	MB89R119
Frequency	13.56MHz	13.56MHz	13.56MHz
Standard	ISO/IEC14443-Type B	ISO/IEC15693	ISO/IEC15693
Modulation	ASK10%	ASK10%	ASK10%，ASK100％
Memory size	2,048bytes	2,048bytes	256bytes
User memory size	2,016bytes	2,000bytes	232bytes
Block configuration	Original specification	8bytes/block	4bytes/block
Operating temperature	−10℃ to 70℃	−20℃ to 85℃	−20℃ to 85℃
Data retention	10 years @ 55℃	10 years @55℃	10 years @55℃
Endurance	10^{10} cycles	10^{10} cycles	10^{10} cycles