Because of large density memory and fast writing speed, FRAM RFID is the best solution for factory automation applications requiring frequent production data logging and efficiency of operation, and for maintenance applications requiring real time operation and on-site confirmation of maintenance history and parts information.

Production Management (Factory Automation)
The benefit of FRAM RFID tags as large density data carriers lies in their ability to store large amounts of information and to be written fast and frequently—which makes them ideal for use in production management in factories like automobile plants. The tags can record such information as production and inspection histories, customized parts and operation information, manuals, and so on. Off-line data management improves the flexibility of the production line, and shortens production lead times.

Aircraft Maintenance Management
Fujitsu’s FRAM RFID has been selected for use in the maintenance of Boeing’s aircraft. In order to manage the many kinds of parts in an aircraft, the RFID tags have been standardized as data carriers to keep track of maintenance history, maintenance manuals, parts information, and more. This RFID solution is expected to enhance the accuracy of all Boeing aircraft maintenance, cut turnaround time, and result in much safer and more efficient aircraft management.

Great Promise as Data Carrier Tags
Because of the large density memory and fast writing capability, the maintenance application fields are not just the FA and aviation industries, but other industries as well—a partial listing of which would include: the electricity industry, the construction industry, the infrastructure, transportation (vehicle, track, road), and rental machinery industries, and the facilities management industries (gas, water, chemicals, and oil).

Introducing Fujitsu Semiconductor’s FRAM RFID LSI; “FerVID family”
FRAM (Ferroelectric RAM) is the non-volatile memory that outperforms the conventional non-volatile memories EEPROM and Flash. Unlike EEPROM and Flash, FRAM does not require a higher internal voltage for writing operation, and this feature provides you with virtually unlimited read/write endurance, and fast writing speed. This advantage realizes large density of storage memory and stable communication distance for read and write operation. And unlike EEPROM and Flash, FRAM is resistant to sterilization by gamma-ray. Thus more and more RFID tag manufacturers around the world are selecting Fujitsu’s “FerVID family” of FRAM RFID LSI as the best RFID for data carriers.

FRAM RFID Can Realize a Wider Range of RFID Applications than Ever Before
FerVID family consists of large density FRAM which are available for HF (13.56MHz) and UHF (860MHz—960MHz) applications. The feature of large density memory is perfect for RFID use in factory automation, maintenance, asset management, and logistic tracking. And the feature of gamma-ray sterilization hardness is perfect for RFID use in the medical, pharmaceutical, biomedical, foods, and cosmetic industries. Moreover, the serial interface feature enables RFID to connect a microcontroller, and expands the possibilities of RFID into the realm of embedded applications.

Expand the Possibilities of Your RFID Tags with FRAM
The remarkable feature of FRAM RFID for healthcare applications is strong radiation hardness, which permits RFID to be attached to products to be sterilized by gamma-ray. Unlike conventional memory used for RFID, FRAM has feature of gamma-ray sterilization hardness. This feature is of great importance to the medical, pharmaceutical, and biomedical industries, which are continuously seeking to improve the safety and reliability of traceability management through the entire cycle from production and sterilization to logistics, warehousing, use in hospital, and waste.

Traceability of Products
Unlike conventional RFID tags, FRAM RFID tags can be placed on a medical or pharmaceutical product at the production stage before gamma-ray sterilization takes place from outside the package. After shipment, RFID tags can record the history of the logistic process as well. Thus, FRAM RFID enables complete visibility during all stages of the process, and thereby prevents counterfeiting. Also, when connected with sensors, FRAM RFID will be able to improve the reliability of the logistic process by recording the environmental history, such as temperature and physical stress.

Traceability in Hospitals
FRAM RFID is also expected to improve safety management and operational efficiency in hospitals. For example, the right quantity of medicines must be kept in stock at all times, and any expired medicines must be detected. The number of surgical tools must be checked before and after operations. Patient medication must be executed with flawless accuracy. These are some of the areas where FRAM RFID can help. Also, the penetration of NFC smart phones and tablet terminals into the medical scene may increase potential applications of FRAM RFID.

Operating Parameter Setting
The key feature of RFID is that data can be read and written by RF, even if RFID is embedded in products and packaging. This feature creates new value for the microcontroller with which RFID is connected. In product distribution, for example, the parameter data for individual customers can be written in FRAM even after the product is packed, and in the same way important traceability information and keys can be added during the logistic process or after arrival at the retail site. Then when the product is used for the first time, the microcontroller can load the data stored in FRAM to activate the product, or if the data is missing, the product may not be activated. Also if FRAM is used for parameter memory, the operational condition of the microcontroller can be changed by RF.

A Tool for the Realization of New RFID Possibilities
Fujitsu Semiconductor has developed an evaluation board for embedded use in which FRAM RFID is connected to a microcontroller, several sensors, and an LCD. Customers can use this board as a tool to explore new ideas and possibilities for RFID.
FerVID Family for UHF Passive RFID  MB97R803A, MB97R804B, MB97R7051, MB97R8050

- ISO/IEC18000-6-3 (Type C), EPC C1G2 Ver. 1.2.0 compliant
- Worldwide UHF frequency (860-960MHz)
- Large memory density and fast writing performance
- Stable communication distance between writing and reading (the same distance)
- Write Lock and Read Lock feature with password
- Anti-collision feature
- Serial interface for Embedded RF solutions

<table>
<thead>
<tr>
<th>Memory size</th>
<th>MB97R803A</th>
<th>MB97R804B</th>
<th>MB97R7051</th>
<th>MB97R8050</th>
</tr>
</thead>
<tbody>
<tr>
<td>User memory size</td>
<td>4K Bytes</td>
<td>12K Bytes</td>
<td>36 Bytes</td>
<td></td>
</tr>
<tr>
<td>User memory size</td>
<td>4,624 Bytes</td>
<td>16K Bytes</td>
<td>4K Bytes</td>
<td></td>
</tr>
<tr>
<td>Operating frequency</td>
<td>860-960MHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modulation</td>
<td>DSB-ASK, SSB-ASK, PH-ASK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data coding</td>
<td>26.48, 52.97kbps (Response to Fast command)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating frequency</td>
<td>13.56MHz ± 7kHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modulation</td>
<td>DSB-ASK, SSB-ASK, PH-ASK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data coding</td>
<td>26.48, 52.97kbps (Response to Fast command)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data retention</td>
<td>10 years (+55℃)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Read/Write endurance</td>
<td>1010 times</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Read/Write endurance</td>
<td>50cm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shipping Form</td>
<td>Sawn wafer</td>
<td>Package 5500-16</td>
<td>Male. Package 4500-16 (for 1044)</td>
<td>Sawn wafer</td>
</tr>
<tr>
<td>Fail Bit detection</td>
<td>MAP* (* unit format), Read Mark (custom)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FerVID Family for HF Passive RFID  MB89R118C, MB89R119B, MB89R112A/B

- ISO/IEC15693, 18000-3 Mode1 compliant
- Large memory density and fast writing performance
- Fast reading performance with custom commands
- Outstanding gamma-ray radiation hardness
- Anti-collision feature
- High-input capacitance for antenna downsizing requirements
- Serial interface for embedded RF solutions (in development)
- Ucode tag certification by Ubiquitous ID Center

<table>
<thead>
<tr>
<th>Memory size</th>
<th>MB89R118C</th>
<th>MB89R119B</th>
<th>MB89R112A</th>
<th>MB89R112B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory size</td>
<td>126K bytes</td>
<td>256K bytes</td>
<td>96K Bytes</td>
<td>256K bytes</td>
</tr>
<tr>
<td>User memory size</td>
<td>32K Bytes</td>
<td>2K Bytes</td>
<td>8K Bytes</td>
<td>16K Bytes</td>
</tr>
<tr>
<td>Block structure</td>
<td>8 bytes, 256 Blocks</td>
<td>64 bytes, 4K Blocks</td>
<td>32 bytes, 2K Blocks</td>
<td>64 bytes, 4K Blocks</td>
</tr>
<tr>
<td>Operating frequency</td>
<td>13.56MHz ± 7kHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modulation</td>
<td>ASK (100%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data coding</td>
<td>1 out of 4 (out of 2 is not supported)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi carrier</td>
<td>One sub-carrier (Two sub-carrier is not supported)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>26.48, 52.97kbps (Response to Fast command)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commands</td>
<td>ASK/FSK commands, Custom commands: Fast Read/Write, ASK/FSK commands, Custom commands: Fast Read/Write</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input capacitance</td>
<td>24pF (100%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data retention</td>
<td>10 years (+55℃)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Read/Write endurance</td>
<td>1010 times</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shipping Form</td>
<td>Sawn wafer (Plating bump, Backwaffled up to 150μm)</td>
<td>Package OFF-24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fail Bit detection</td>
<td>MAP* (* unit format), Read Mark (custom)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Target Applications and Advantage of FerVID family

**Target Applications**
- Logistics → Improved Accuracy and Efficiency
- Farm → Improved Productivity
- Factory → Improved Throughput

**Advantage**
- Medical → Detailed Traceability
- Logistics → Improved Accuracy and Efficiency
- Farm → Improved Productivity
- Retail → Optimal Inventory Control

**Target Applications**
- Transportation record
- Use history record
- Health management of livestock
- Environment record
- Transportation record
- Medical
- Use history record
- RFID
- Factory
- Infrastructure
- Transportation
- Logistics
- Product control
- Confirmation of information
- RFID
- Retail
- Data log
- Maintenance record

**FerVID Family Production Roadmap**

- HF 13.56MHz
  - UHF 860-960MHz
  - Next Production Development
  - Contactless Authentication
  - Energy Harvesting
  - Sensor I/F
  - Maintenance of equipment and parts
  - Security Feature
  - EPC Feature

**FerVID Production Roadmap**

- MB97R8051
  - UHF 64Kb
  - Next Production Development
  - Maintenance of equipment and parts
  - Energy Harvesting
  - Sensor I/F
  - Contactless Authentication
  - Security Feature
  - EPC Feature

**Target Applications**
- Transportation record
- Product control
- Confirmation of information
- Batch information record
- Parameter re-program
- Retail
- Logistics
- Computer
- RFID
- Logistics
- Product control
- Confirmation of information
- Batch information record
- Parameter re-program
- Retail
- Logistics
- Computer
- RFID
- Logistics
- Product control
- Confirmation of information
- Batch information record
- Parameter re-program
- Retail
- Logistics
- Computer
- RFID
- Logistics
- Product control
- Confirmation of information
- Batch information record
- Parameter re-program
- Retail
- Logistics
- Computer
- RFID
- Logistics
- Product control
- Confirmation of information
- Batch information record
- Parameter re-program
- Retail
- Logistics
- Computer
- RFID
- Logistics
- Product control
- Confirmation of information
- Batch information record
- Parameter re-program
- Retail
- Logistics
- Computer
- RFID