

Embedded RFID development kit with FM3 Family Microcontroller

MB9BF506RA-EVB-RF-01

As the 1st approach of embedded RFID solutions, FUJITSU SEMICONDUCTOR has released an embedded RFID development kit consisting of FRAM based UHF RFID and FM3.

Introduction

FUJITSU SEMICONDUCTOR develops and manufactures RFID LSI products for RFID using FRAM (Ferroelectric Random Access Memory). With the unique feature of FRAM such as high speed writing, large density memory, and Gamma-ray/E-beam sterilization resistance, FRAM RFID has been used for added value applications and also for embedded application as a new approach. FUJITSU SEMICONDUCTOR has now started selling an embedded RFID development kit on which our FM3 family microcontroller and UHF-band RFID LSI "MB97R804B" are connected via serial interface.

Embedded RFID solutions by FM3 + RFID

The features of embedded RFID solutions enables to read and write from RF reader/writer to FRAM as a RFID feature, and enables to read and write from Microcontroller (hereafter, MCU) to FRAM as an external memory feature of MCU in the same way.

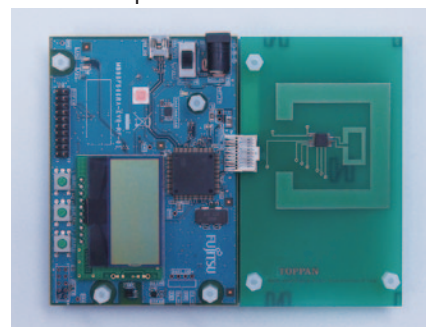
One example of RFID features is data logger. If it is assumed that sensor is connected with MCU and sensor data is taken based on certain conditions

such as time interval, threshold value, and then the data is stored into FRAM as an external data logger. Then the logging information can be taken from RF interface. On the other hand, if it is assumed that FRAM is used as parameter setting memory, the conditions of sensor information can be changed from RF interface and MCU refers the data through serial interface when MCU accesses FRAM. As a result, FRAM can be used for both data logger and parameter setting. This is a key feature of FRAM RFID for embedded solution.

This approach is commonly applied for different application. If the information such as operation setting conditions, application parameters, and adjustment of MCU firmware are stored in FRAM, the information can be managed by RF without connecting wire. As an example, if the electronic paper is connected with MCU, the display information and parameters could be changed by RF.

We had already introduced the same approach as embedded RFID applications that combine 32-bit FM3 Family equipped with the ARM® Cortex™-M3 named "MB9BF506R" and UHF-band FRAM RFID LSI named "MB97R8030"*1. Through the inquiries from customers and the support of evaluation and development, we've improved the specifications and feature,

Photo 1 Top view



and embedded new RFID LSI named "MB97R804B" as a successor model of "MB97R8030"*2 and connected with the FM3 Family "MB9BF506RA."

The access arbitration feature of "MB97R804B" improves the accessibility to FRAM from RF and serial interface, and the communication characteristics are also improved when MCU is connected with RFID LSI.

*1: See Vol.29 No.1.

*2: See Vol.29 No.2.

Specifications

As shown in **Photo 1**, the product consists of an MCU board assembled with MB9BF506RA and an antenna board assembled with MB97R804B, connected with an SPI interface. On the MCU board, temperature/humidity sensor, illuminance sensor, and 3-axis accelerometer are connected to the MCU

via I²C interface, and real-time clock (RTC), and LCD are assembled. With this combination, it is demonstrated that the sensor data are displayed on the LCD and they're stored into FRAM at the programmed interval, then reader/writer can take the logging data. The antenna board is tuned for around 915MHz as center frequency.

In addition, the board can be connected with PC via USB interface, which enables to load MCU firmware or

demo/evaluation program. And the ICE interface makes customers to develop firmware and customize application. In addition, RS232C (TX, RX) and I²C/ SPI/UART (exclusively selected) are provided as reserved interface, which enable customers to connect additional sensors and controllers for customized evaluation.

Figure 1 presents three usages that the board can provide.

Demonstration

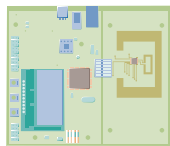
The demonstration program is installed as default firmware. As a sensor data logger demo, sensor data are stored into FRAM and taken from reader/writer. And as a display demo, the character displayed on LCD is changed by reader/writer. The demo program of reader/writer is developed for Atid's handheld reader AT870.

Because the demo program manual

Figure 1 Three Usage of Development Kit

Demonstration

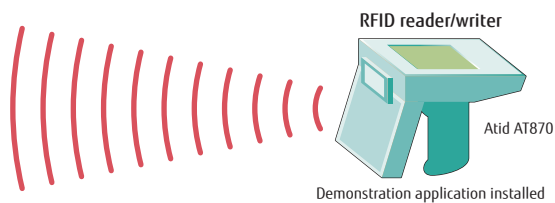
FM3 + RFID demonstration board



A dedicated demonstration application is preinstalled.

Deliverables

- Demonstration operation manual
- Demonstration board command manual
- Demonstration board hardware manual
- Demonstration application (for FM3: binary data)
- Demonstration application (for AT870: binary data)



Evaluation

PC evaluation tool



USB

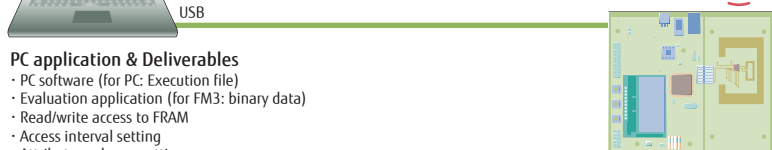
PC application & Deliverables

- PC software (for PC: Execution file)
- Evaluation application (for FM3: binary data)
- Read/write access to FRAM
- Access interval setting
- Attribute and area setting
- Repeat access setting
- PC software operation manual

RFID reader/writer
(Customer's reader/writer)



FM3 + RFID demonstration board



Development

FM3 and RFID application development



ICE



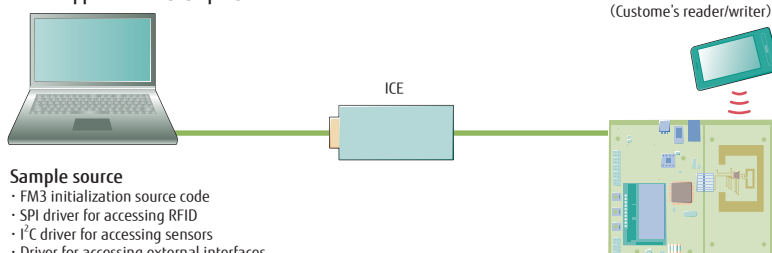
Sample source

- FM3 initialization source code
- SPI driver for accessing RFID
- I²C driver for accessing sensors
- Driver for accessing external interfaces
- Source code manual

RFID reader/writer
(Customer's reader/writer)



FM3 + RFID demonstration board



and the memory map information for the program are provided, it is possible for customers to develop the same demo for their own reader/writers.

Evaluation

In order to evaluate FRAM access from serial interface and RF interface, the evaluation tool is provided. The evaluation program is executed from PC via USB interface and can evaluate the reading and writing operation to FRAM.

Because the program can control the address, data, number of access, and so on, customer can evaluate how arbitration feature works before the development of customized software. Also the sample source enables customers to develop their own evaluation tool.

we plan to develop HF products for embedded solutions as well as UHF products in order to apply either of them according to the market requirement.

FUJITSU SEMICONDUCTOR intends to work together with customers for creating and developing new values on RFID usage scene and embedded RF solutions as an added value of MCU products. ■

Development

ICE interface enables customers to connect FM3 with ARM MCU development tool and develop own firmware for customized application. The sample source codes of I²C driver to access sensors and the code of SPI driver to access FRAM are provided for the development.

Future Approach

In order to penetrate embedded FRAM RFID solutions into the market and make customers evaluate this new RFID approach, FUJITSU SEMICONDUCTOR began to sell the evaluation kit introduced above. Taking advantage of the unique features of FRAM RFID such as high speed and large density memory,