

The Latest RAM Solutions for Mobile Phones: Mobile FCRAM™ Family

To support the development of multi-functions in mobile phones, FUJITSU has commercialized a Mobile FCRAM™ configured with a high-speed page mode and 1.8V power supply.

This article describes the latest trends in the Mobile FCRAM™ RAM solution.

Introduction

In recent years, cellular phones are coming out with sophisticated function such as sending and receiving e-mail, access to internet, receiving and playing MP3 file, and capturing images with built-in digital cameras, beside the simple function of voice calling. To keep up with this trend, the memory modules built into cellular phone have to offer higher performance and larger storage densities.

Since FUJITSU has developed 16M bit to 64M bit line of Mobile FCRAM*¹ based on FUJITSU's proprietary FCRAM*² architecture, that has high speed and low power characteristics, the many of 2G and 2.5G cellular phone adopts Mobile FCRAM as alternative to SRAM. The Mobile FCRAM series adopts an asynchronous SRAM interface (standard memory interface in cellular phone RAMs) so that system designer can easily upgrade memory to Mobile FCRAM from SRAM without major changes in system configuration.

Ever since the introduction of Mobile FCRAM, FUJITSU's Mobile FCRAM and other large density pseudo SRAM devices became standard choice of memory installed in cellular phone used widely in Japan, in addition to the two conventionally available option, NOR-type Flash memory and low power SRAM. This trend of adopting the Mobile FCRAM as an SRAM alternative is taking root in overseas

cellular phone market where full-scale introduction and emerging demand are expected.

Enhancement on speed and supply voltage MB82DPS02183B, 32M bit Mobile FCRAM, is the first of Mobile FCRAM to support a high speed page mode function that dramatically improves performance when consecutive address access occurs within the same page.

All the function of a conventional cellular phone is controlled in the based band block. However in some of high-end handset recently adopts application CPU to support sophisticated function. High speed page mode of Mobile FCRAM contributes performance enhancement for high-end handset such as application data processing. In addition to high speed page mode, MB82DPS02183B is operational with 1.8V power supply with respect to the trend of migration to lower supply voltage.

Market Trends

The commercial mobile phones currently on the market are predominantly 2.5G types relying on methods such as PDC or cdmaOne. The 2.5G models now introduced support functions such as Web browsing, built-in digital cameras, and Java applications, and many are capable of accessing servers to download programs, or appending e-

mail with photos shot by built-in digital cameras. All of these functions entail the processing of tremendous volumes of data, and higher-performance systems are being rapidly developed to handle that processing demand. Mounted memories with larger densities and higher performance are

crucial in today's development efforts.

Of course, 2.5G is just another rung up the ladder. Even higher performance and larger densities are inevitable in the 3G Mobile phone standard, WCDMA. Services for the WCDMA standard have already been started in Japan, and

Figure 1 Memory Size Trend

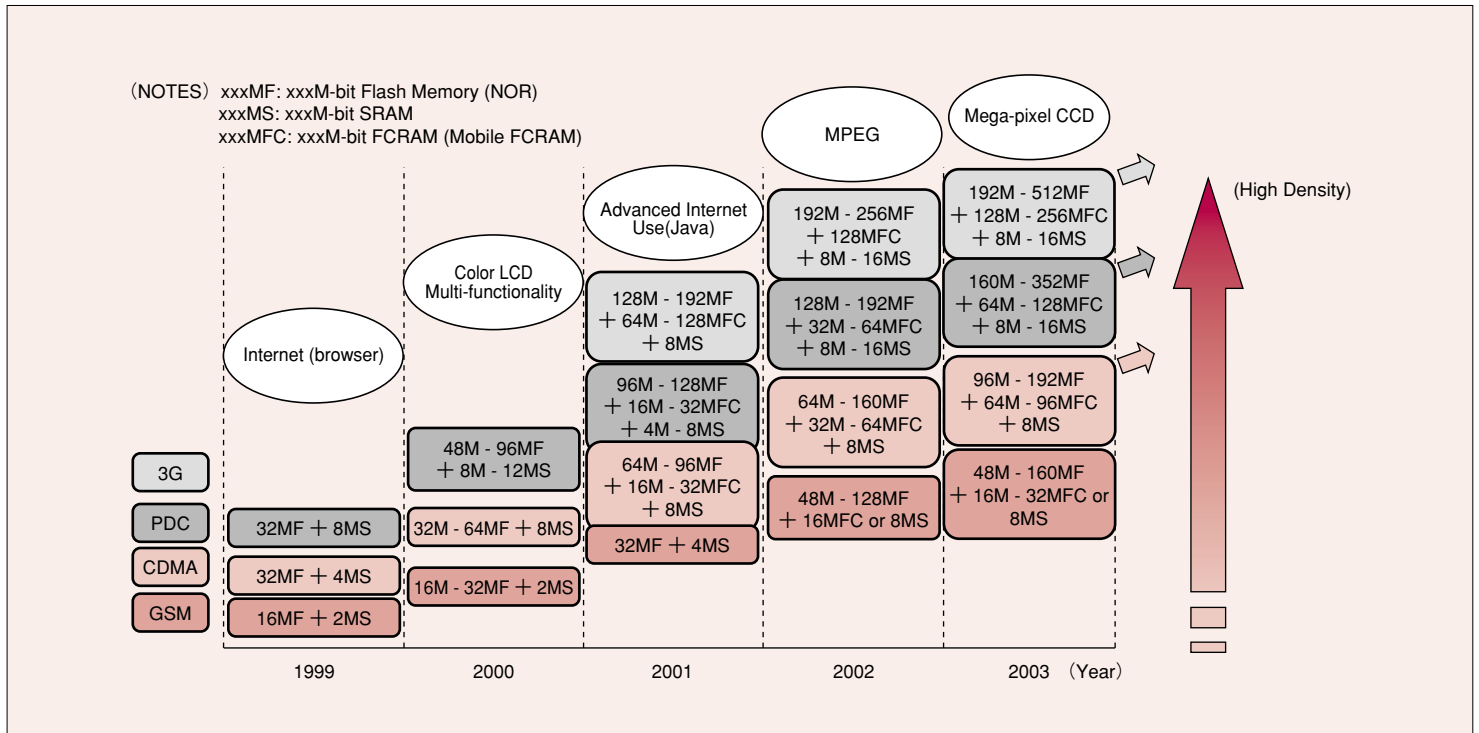
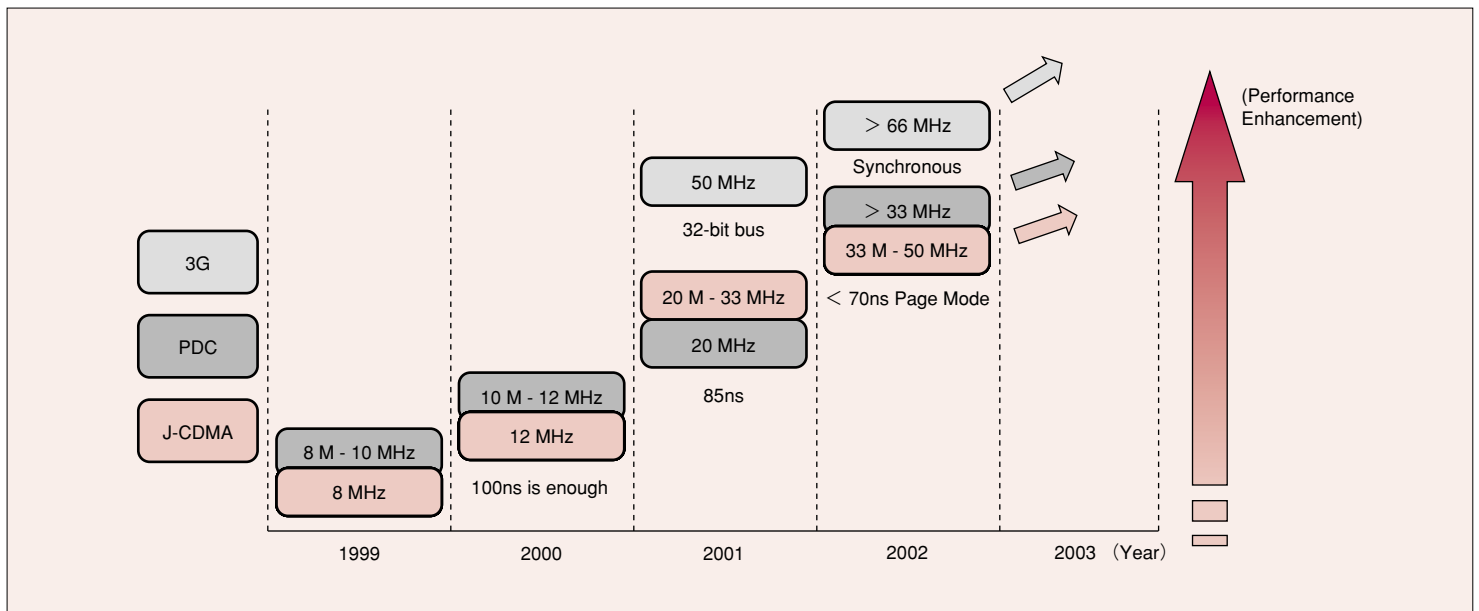


Figure 2 CPU Clock Frequency and Memory Access Trend



they are advancing to the rest of the world.

In European markets, manufacturers are moving further ahead in voltage reduction by installing 1.8V power supplies in GSM and GPRS standard systems rather than in PDC or cdma. **Fig. 1** shows the trend for mobile phone memory density, and **Fig. 2** shows the trend for CPU operation frequency and required memory speed.

Memory System Configuration

Fig. 3 shows the changes in the memory system configuration in Mobile phones.

In conventional Mobile phones, all processes were performed in the baseband section. The program code, character sets, and all other data required for operation were basically stored in the flash memory, while SRAM was used as the work memory (CPU operation area) and storage area for backup data. But with the rapid growth in the demand for memory density to support higher performance and multiple functions, the Mobile FCRAM proposed by FUJITSU was adopted for work memories that previously had been covered only by SRAM. Nowadays, it is an established practice to use SRAM for data-backup and Mobile FCRAM as work memory (**Fig. 4**).

In addition, manufacturers have recently introduced a configuration in which the baseband section (section for processing data communication protocol and basic phone functions) and application section (section for processing/executing applications such as Java other than the baseband functions) are divided, and CPU is mounted respectively.

Product Outline

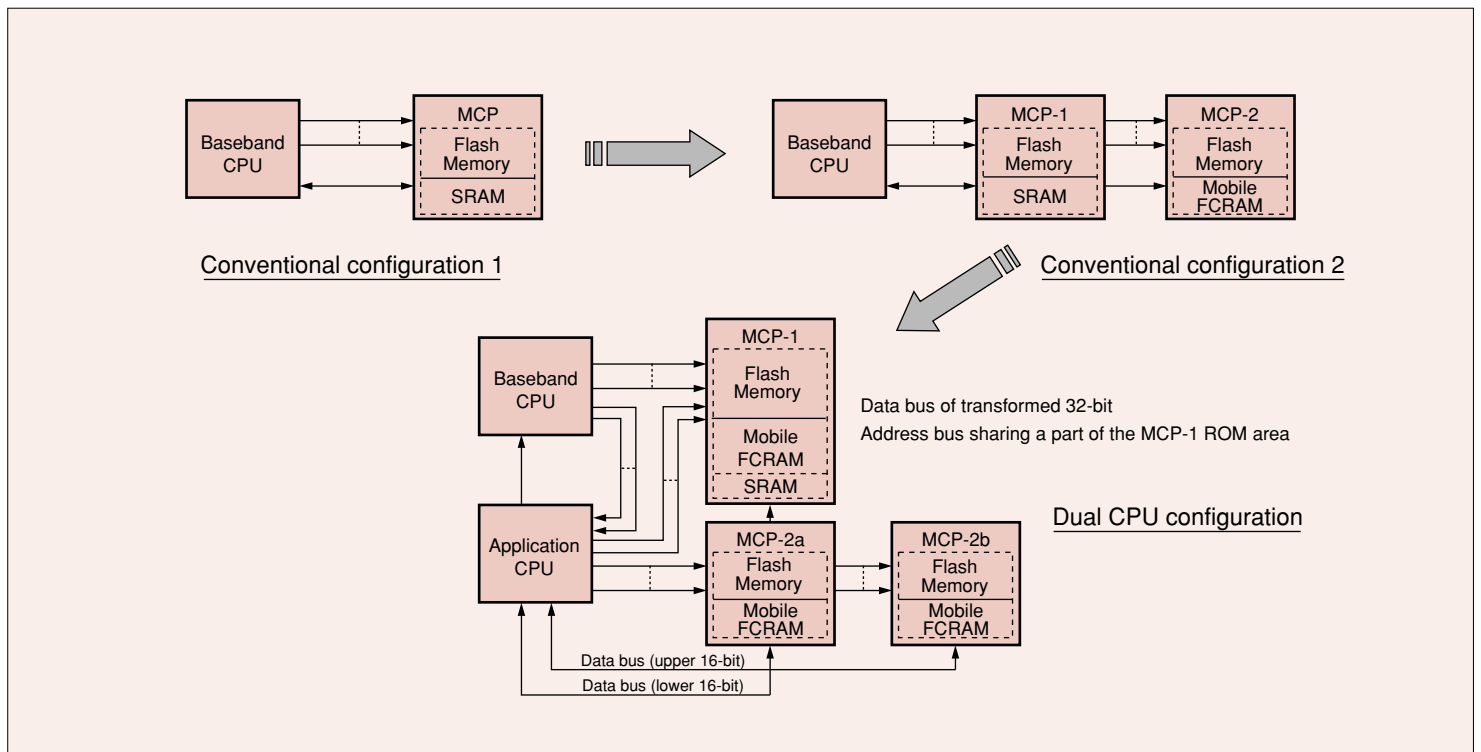
FUJITSU is now mass producing 16M-bit/32M-bit/64M-bit products. And to further advance multi-functionality, the company has already started sample shipment of the first 32M-bit Mobile FCRAM product configured with high-speed page mode function .

Table 1 shows an outline of the Mobile FCRAM family products.

Trend for Higher Speed and Lower Voltage

Thanks to its configuration with the first high-speed page mode function ever installed in a Mobile FCRAM, the

Figure 3 Changes in Memory System Configuration



“MB82DPS02183B (32M-bit)” reads data at higher speed than conventional products. The high-speed page mode is a high-speed accessing function that improves performance by successively reading out 8-word, compiled data within the same page.

Fig. 5 shows the operational timing within the high-speed page mode.

In conventional Mobile phones, all processes are generally performed by a chip set called the baseband chip. In some high-end models, manufacturers also install a second chip to process application data such as moving image data. FUJITSU'S Mobile FCRAM product offers this high-speed page mode to optimize the data processing performance and meet the demand for the processing of application data in high-function models. MB82DPS02183B is also configured with a 1.8V power supply, addressing the trend for voltage reduction.

Future Development

Fig. 6 traces the development trend for FUJITSU's Mobile FCRAM products. Five key targets will be pursued.

- Density increase to 128M-bit
- Speed increase by page mode/burst mode mounting
- Voltage reduction to 1.8V
- Further reduced power consumption
- Support for wafer supply

FUJITSU will continue to propose and supply better solutions to meet market demands and customer needs. ★

NOTES

*1: Mobile FCRAM: Large-density, low-power pseudo SRAM consisting of FCRAM core and asynchronous SRAM interface.

*2: FCRAM (Fast Cycle RAM) is a trademark of FUJITSU LIMITED.

Figure 4 Co-installation to Handle Different Memory Functions

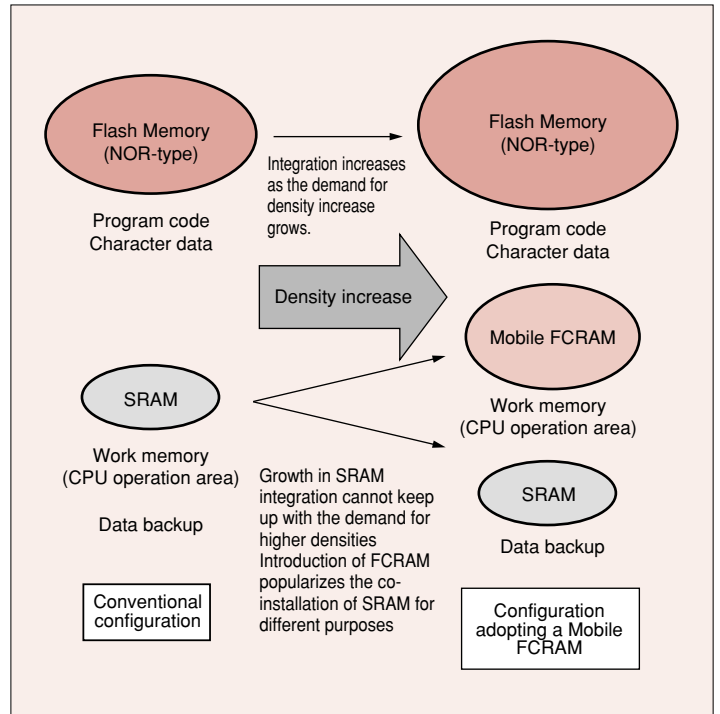


Table 1 Outline of Mobile FCRAM Family Products

Density generation	Configuration	Model name	VCC	Access time	Page access time	Package*	ES	MP
16Mb #1	×16	MB82D01161	2.3 to 3.5V	85/90ns	—	FBGA48/MCP	—	Now
16Mb #2	×16	MB82D01171A	2.3 to 3.5V	80/85ns	—	FBGA48/MCP	—	Now
32Mb #2	×16	MB82D02172A	2.3 to 3.1V	65ns	—	MCP	—	Now
32Mb #3	×16	MB82DPS02183B	1.65 to 1.95V	85ns	25ns	FBGA48/MCP	—	Now
64Mb #1	×16	MB82D04172	2.3 to 3.1V	65ns	—	MCP	—	Now

* MCP has different models. Wafer supply is also possible.

Figure 5 High-Speed Page Mode Operation Timing

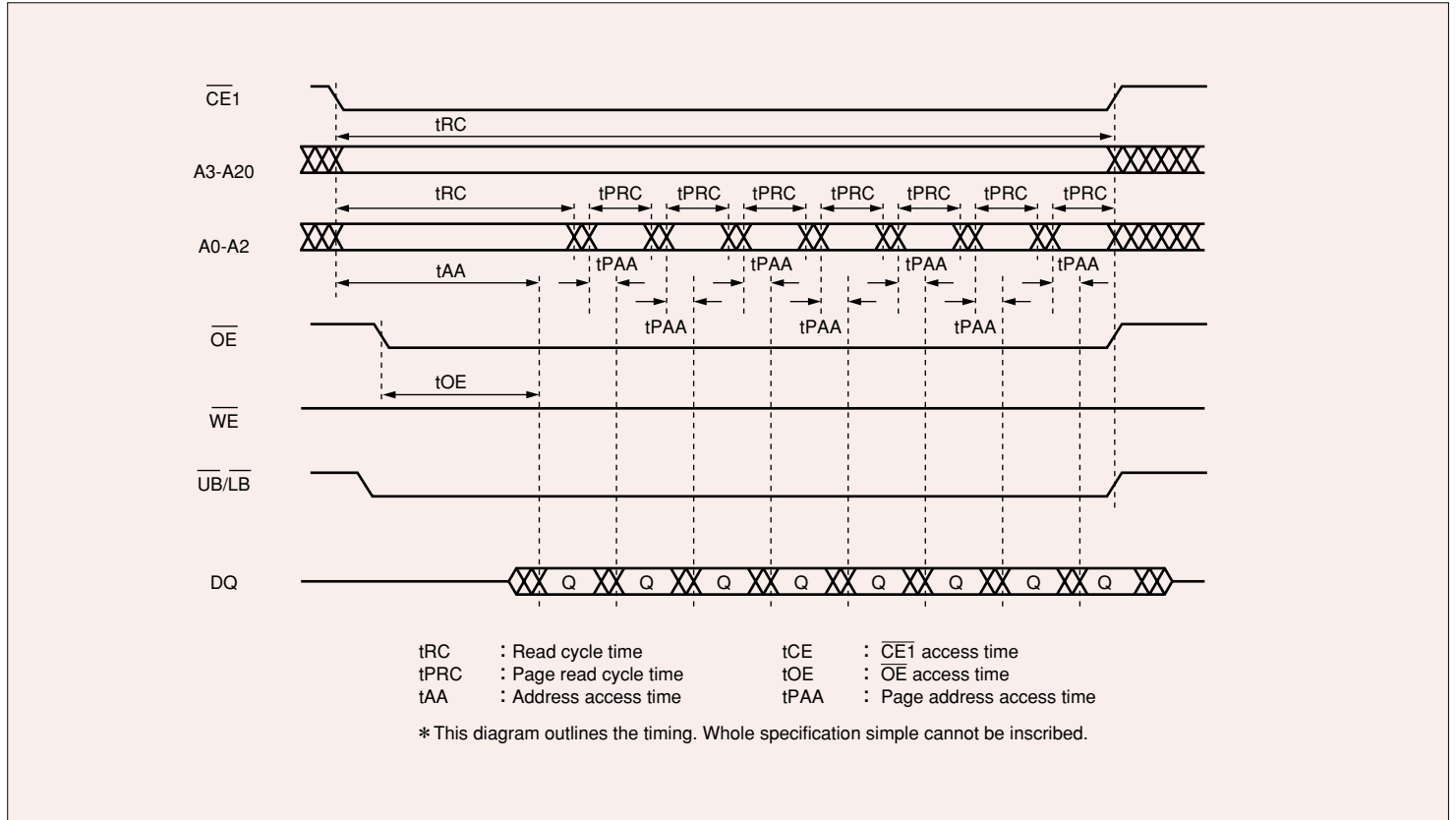


Figure 6 Mobile FCRAM Roadmap

