

# Single 1.8V Power Supply 32 M-Bit Page Dual-Operation Flash Memory: MBM29PDS322TE/BE

*Dual-operation flash memory allows data read, program, and erase operations simultaneously from a 1.8V single power supply, while combining low voltage operation with high-speed access.*

## Features

- **Single 1.8V power supply**
- **Page-mode access capability**
- **Dual-operation functions**
- **Hi-ROM functions**
- **Write-protection function**
- **Accelerated program operation**
- **Automatic sleep mode**

## Product Overview

The portable phone market has grown dramatically in recent years. Worldwide shipments of portable phones in 1999 reached 260 million units and were estimated to have reached 400 million in 2000 (FUJITSU survey data).

Portable phones now incorporate a variety of functions for enhanced communication quality, as well as Internet connection and moving image capability. These new features result in a strong demand for built-in flash memories with fast operating speeds and low power consumption.

To respond to this demand, FUJITSU has developed the MBM29PDS322TE/BE, page-mode access, dual-operation, 32 M-bit flash memory, capable of

executing data read/program/erase functions simultaneously from a 1.8V single power supply.

The primary features of this product are its dual-operation functions at an operating voltage of 1.8V and high access speeds with a page access time of 45 ns. To accommodate its use in low-power products, whenever the element is not accessed within a given time, it automatically switches into sleep mode to conserve power consumption. Other functions include Hi-ROM, write-protection, and acceleration functions.

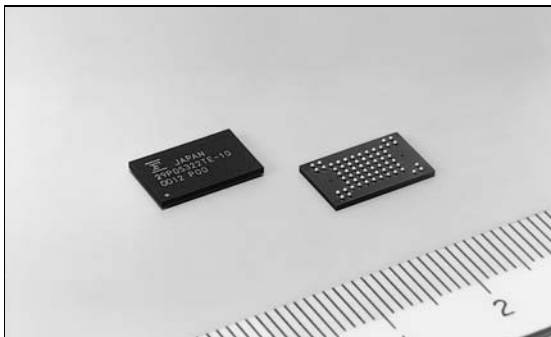
## Product Features

Figure 4 (see p. 20) shows the pin assignments, and Table 1 (see p. 19) shows the product line.

### 1.8V Single-Source Operation

The MBM29PDS322TE/BE is capable of data read/program/erase operation from a single 1.8V power supply. To operate the flash memory at low voltage, it is necessary to increase the voltage within the chip, which is done using a two-stage boost circuit. This circuit not only lowers the supply voltage but also minimizes the increase in chip size and assures sufficient operating margin on the low voltage side. This makes it possible to obtain sufficient word line voltage, so the chip can use exactly the same cells as the highly reliable 3V flash memory.

**Photo 1. MBM29PDS322TE/BE External Views**



### High-Speed Access Capability

Figure 1 (see p. 18) shows page read mode operation.

In page mode access, first the upper address (A20-A2) is selected and the designated page (four words) is read. Then the lower address (A1-A0) is selected and data on the page can be read at high speed in four-word units. The MBM29PDS322TE/BE has an initial access speed of 100 ns and a page access speed of 45 ns.

Figure 2 (see p. 18) shows the relation between access time and supply voltage, and Figure 3 (see p. 18) shows the relation of page read mode to voltage.

### Dual-Operation Functions

In dual operation, one device is divided into two areas (bank 1 and bank 2). Erase or program operations can be performed on a sector in bank 1 at the same time that data is read from a sector in bank 2 (or vice versa). This function is ideal for products, such as portable phones, that require frequent re-program operations.

### Hi-ROM Functions

In addition to the normal memory area, an area (64 Kbytes) is provided for programming special data, such as unique ID numbers. This feature can be combined with specific applications as an advanced security function.

**Photo 2. MBM29PDS322TE/BE Chip**

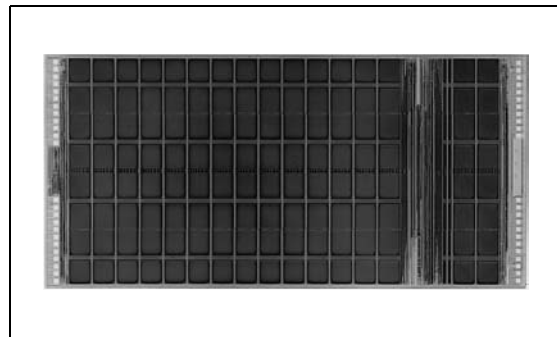


Figure 1. Page Read Mode

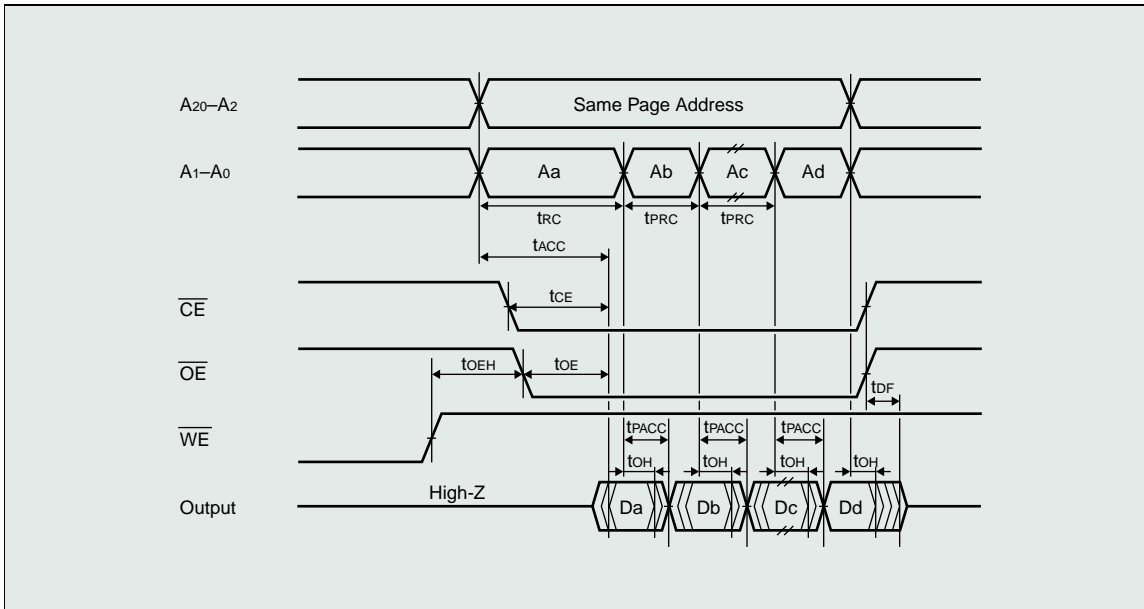


Figure 2. Access Time vs. Power Supply Voltage

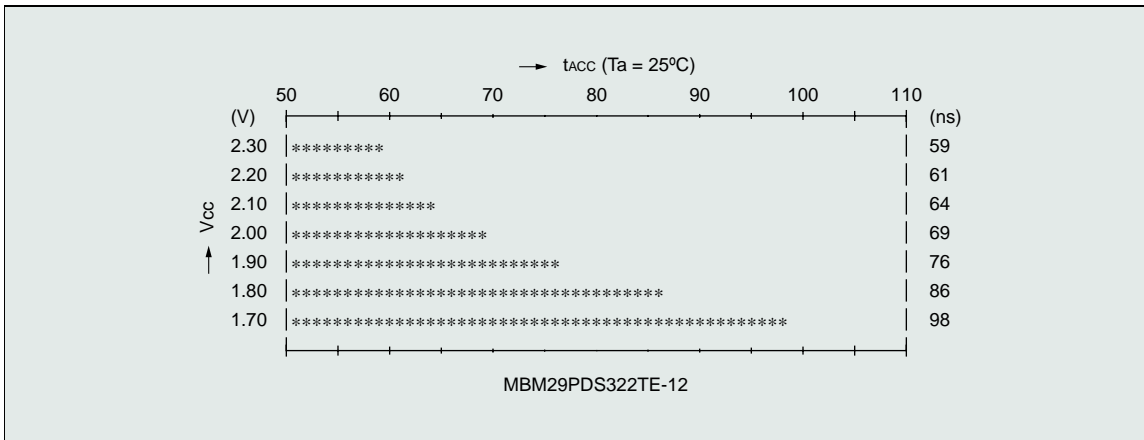
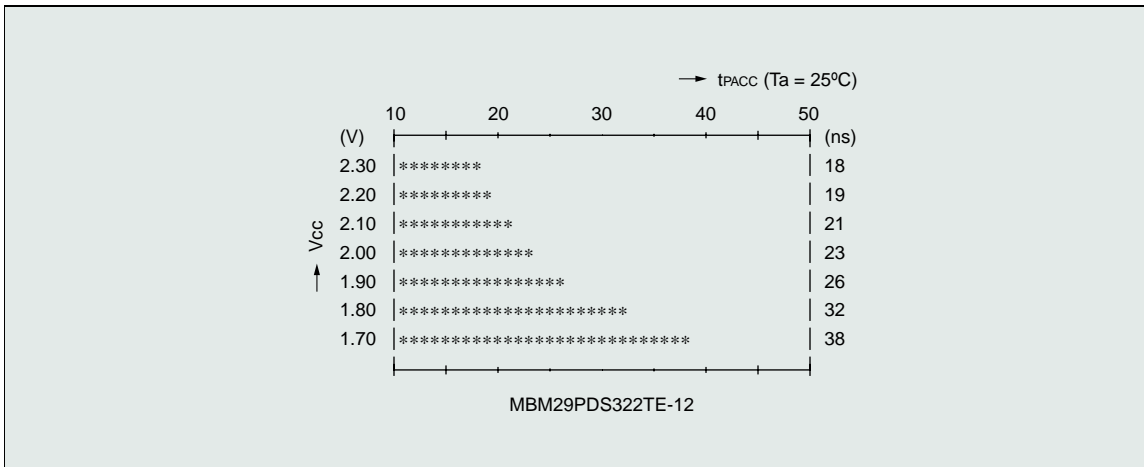


Figure 3. Page Read Mode Access Time vs. Power Supply Voltage



### Write-Protection Function

This hardware operation provides a simpler form of write protection. Regardless of whether normal sector protection is applied, when the WP#/ACC pins are set to 'L' level, the outermost two sectors are protected simultaneously. These outermost sectors are small sectors (8 Kbytes x 8) of the lowest part of the address (MBM29PDS322BE) or the highest part of the address (MBM29PDS322TE).

In previous flash memories, when high voltage ( $V_{ID}$ ) is applied to the RESET# pin, all sector protection is temporarily unprotected, allowing for the possibility that essential data could be permanently altered. The write protection function remains in effect even during such temporary sector protection period.

### Accelerated Program Function

This function provides efficiency for programming

to large quantities of built-in flash memories before systems are shipped.

When high voltage ( $V_{HH}$ ) is applied to the WP#/ACC pins, the MBM29PDS322TE/BE goes into acceleration mode, allowing faster program speeds than normal operation. This function can be expected to reduce program times by 60% of normal.

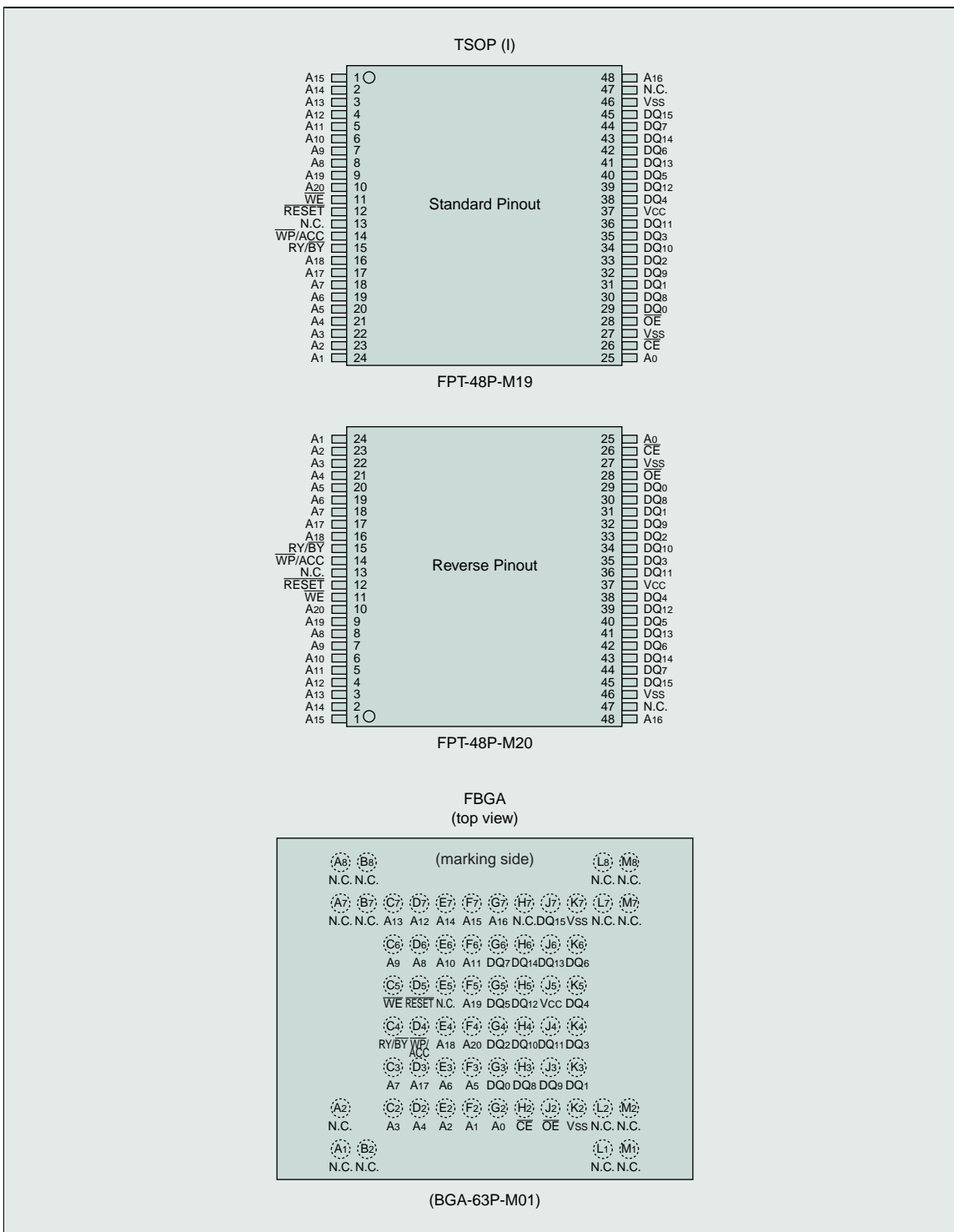
### Automatic Sleep Function

During read operation, whenever the address has not changed for 150 ns or longer, power consumption by the MBM29PDS322TE/BE device is automatically reduced (from a maximum of 21 mA in read operation to 1  $\mu$ A typ.). This function is effective in products such as portable data terminals requiring low power consumption. Once the address changes, the device returns to normal read operations.

**Table 1. MBM29PDS322TE/BE Product Line**

Item		MBM29PDS322TE 10/12	MBM29PDS322BE 10/12
Bank Division		2-Bank Configuration Bank 1 (4 M-bit) Bank 2 (28 M-bit)	
Access Time (max.)	Initial/Random	100 ns/120 ns	
	Page	45 ns/50 ns	
Power Supply Voltage		1.8V to 2.2V	
Power Consumption (max.)	Read	46.2 mW	
	Erase/Program	66 mW	
	CMOS Standby	11 $\mu$ W	
Erase Time (typ.)		1s/Sector	
Program Time (typ.)		16 $\mu$ s	
Boot Block Configuration		Top	Bottom
Package		TSOP-48(I), FBGA-63	

Figure 4. MBM29PDS322TE/BE Pin Assignments





## Benefits

### **Conserves System Power**

Lowering the operating voltage of the flash memory can greatly extend battery life for the entire system.

### **Eliminates External ROM/RAM**

The use of a dual-operation flash memory device allows a system to directly execute the program for reprogramming flash memory without having to load the program from another memory. This allows the same flash memory to perform its own erase or program operations, greatly reducing system cost, mounting space, and power consumption.

### **Enables Efficient Use of Program and Erase Times**

During erase/program access to one sector, the device can switch to the other bank and the read contents of another address without interrupting the erase/program operation. In other words, specifying an address in another bank releases the data bus in the flash memory from use for status data and returns it to use for the output of stored information. Thus, with the appropriate software provisions, the apparent erase/program time of a device can essentially approach zero. The dual-operation flash memory can thereby improve the processing speed of the device in which it is installed.

## Applications

The single 1.8V, dual-operation flash memory can be used in applications such as the following:

- Systems requiring low power consumption and multiple functions in a high performance flash memory
- Systems requiring program code updates
- Systems storing ID, parameters, or other data on an EEPROM
- Systems using external RAM or ROM
- Systems requiring frequent reprogramming

## Future Development

This article has introduced a new product, the MBM29PDS322TE/BE, as a solution primarily for low power consumption and high performance in portable data devices.

FUJITSU has long been a provider of flash memory products in response to our customers' requirements, and the addition of this product further extends our complete line of offerings.

In the future, FUJITSU intends to continue to fill out our family of products featuring lower operating voltages, greater functionality, and larger-density flash memories. ◆