32 M-Bit Page Mode Flash Memory with x16/x32-Bit Bus Width: MBM29PL3200TE/BE

The industry's first page mode flash memory with 32-bit bus width offers expanded transfer rates and high-speed reading performance.

Features

- **High-speed read operation**

- **3V single power supply**

- **Pin compatible with existing x32 mask ROM products**

- **x16-bit or x32-bit bus widths**

- **Boot-block sectors**

- **Hi-ROM function**

- **Write-protection function**

- **Acceleration function**

Product Overview

FUJITSU has developed the MBM29PL3200TE/BE 32 M-bit high-speed page mode flash memory, featuring the industry's first 32-bit data transfer rates, for use in applications such as laser printers and car navigation systems.

In recent years, the advent of high-speed laser printers, as well as car navigation systems with faster map searching and additional communication functions, has led to a dramatic increase in the speed and performance of these products. This, in turn, has led to demand for faster built-in microprocessors, and their data transfer rates have advanced from earlier x8-/x16-bit levels to 32- and 64-bit levels. Similar demand has grown for built-in flash memories with faster processing speeds and expanded data transfer rates.

Photo 1.   MBM29PL3200TE/BE External Views

Photo 2.   MBM29PL3200TE/BE Chip
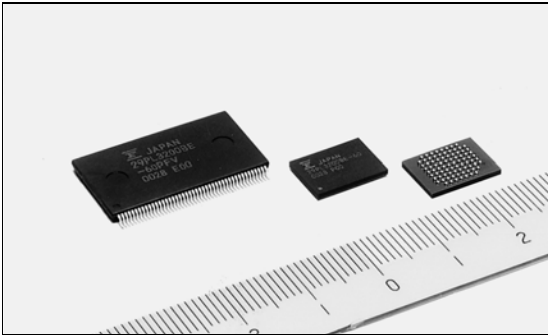
The MBM29PL3200TE/BE was developed with an emphasis on faster access speed, resulting in a page mode flash memory with a high-speed reading performance and a capability for maximum speed page reading (25 ns). Also, the data transfer rate is doubled from the earlier x8-/x16-bit to x16-/x32-bit, providing the ability to process large volumes of data at one time and providing improved compatibility with microprocessors installed into the same system.

The pin assignments (see Figure 4 on p. 80) of the SSOP package are based on a page access type mask ROM so that they can be placed on the same board as a mask ROM.
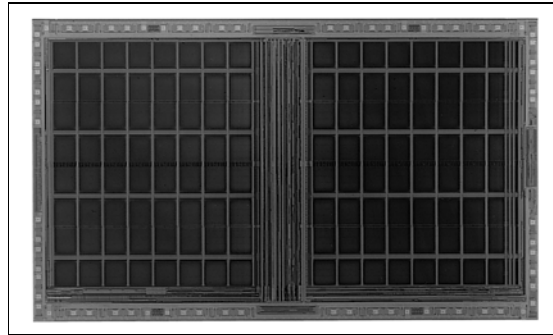
Additional features include a Hi-ROM function to prevent unauthorized high-volume copying, a write-protection function for hardware protection of boot-block sectors containing system programs, and an acceleration function to enable high speed programming when the MBM29PL3200TE/BE is installed into a system.

Product Performance

Table 3 (see p. 82) lists the products in the series.

High-Speed Read Operation

Figure 1 (see p. 78) illustrates page read mode. In page mode access, first the higher address (A19 to A2) is selected to read a designated page (eight words or four double words). Then, the lower address (A1 and A0) is selected to read the data on the page at high speed in eight-word or four double-word units.

> "... random access time of 70 ns and an access speed within a page of 25 ns."

The MBM29PL3200TE/BE has a random access time of 70 ns and an access speed within a page of 25 ns.

Figure 2 (see p. 79) shows the relationship between access time and power supply voltage. Figure 3 (see p. 79) shows the relationship between power supply voltage and page read mode time.

3V Single Power Supply

The MBM29PL3200TE/BE is able to perform read, program, and erase operations from a single 3V power supply. Because a 12V power supply is not needed, systems can be configured without additional components such as voltage conversion pins.

Compatible with Existing Products

The MBM29PL3200TE/BE programs and erases using the same instruction sequence as 3V single power supply flash memories already on the market.

x16- or x32-Bit Bus Width

The DW/$\overline{W}$ pin is used to select double word (32-bit) mode or word (16-bit) mode.

When the DW/$\overline{W}$ pin is set to the 'H' level, the device operates in double-word mode, reading and writing data from the DQ31-DQ0 pins. When the DW/$\overline{W}$ pin is set to 'L' level, the device operates in word mode. In this case, the DQ31/A$_{-1}$ pins become the lowest address bit, and the DQ30-DQ16 pins are set to high impedance.

Figure 4 (see p. 80) shows the pin assignments.

Boot-Block Sectors

The sector configuration is 16 K-word x 1, 8 K-word x 2, 96 K-word x 1, and 128 K-word x 15, allowing re-programming in small units when storing small programs, such as boot programs, parameters, and the BIOS. The MBM29PL3200TE/BE is available with the smaller address spaces either in the higher address area (TE: a top boot-block model) or in the lower address area (BE: bottom boot-block model).

Table 1 (see p. 81) shows the sector configuration of the top boot-block model, and Table 2 (see p. 82) shows the sector configuration of the bottom boot-block model.

Hi-ROM Function

A special area (512 words) is provided outside the normal memory area, in which data can be programmed one time only. This area can be used for programming special data (such as unique ID numbers) that can be used in combination with applications to provide an advanced security feature.

Write-Protection Function

The MBM29PL3200TE/BE provides a simpler, hardware-based write-protection function. When an 'L' signal is input at the $\overline{WP}$ pin, regardless of whether normal sector protection is applied, this function protects the small sectors (16 KW x 1) at the lowest (MBM29PL3200BE) or highest (MBM29PL3200TE) address.

Acceleration Function

The acceleration function is effective when programming large volumes of flash memories as they are installed into systems at the factory. Apply high-voltage (V_{HH}) to the ACC pin to go into acceleration mode, in which programming is accelerated above the normal speed. This function enables program time to be shortened to 60% of normal.
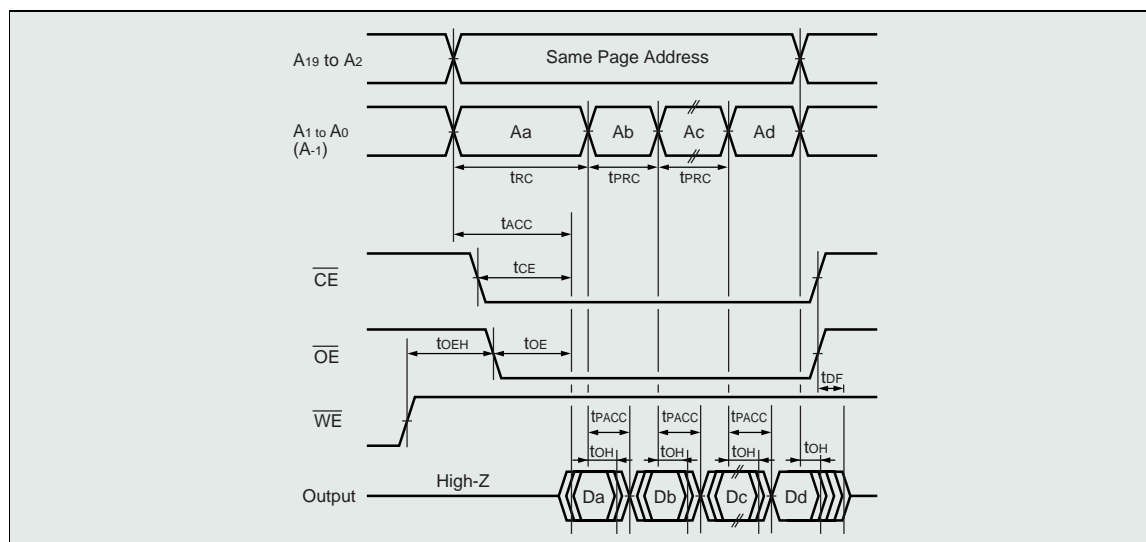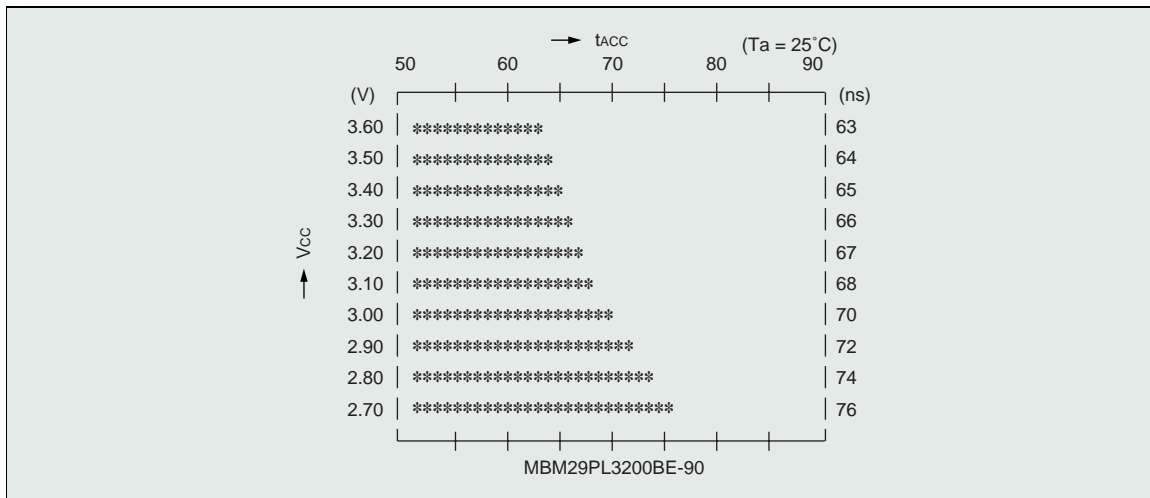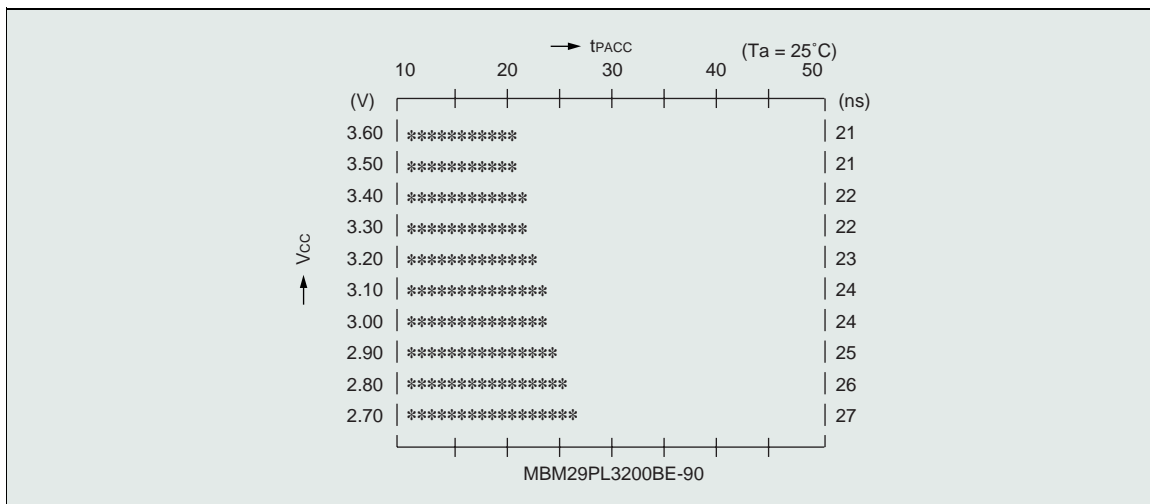
Figure 1.   Page Read Mode

Figure 2.   Access Time vs. Power Supply Voltage

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

Figure 4. MBM29PL3200TE/BE Pin Assignments


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                    SSOP
                  (top view)

    N.C. ⊏ 1  ○              90 ⊐ N.C.
    N.C. ⊏ 2                 89 ⊐ N.C.
    N.C. ⊏ 3                 88 ⊐ ACC
    N.C. ⊏ 4                 87 ⊐ WP
    N.C. ⊏ 5                 86 ⊐ WE
     A0 ⊏ 6                  85 ⊐ N.C.
     A1 ⊏ 7                  84 ⊐ N.C.
     A2 ⊏ 8                  83 ⊐ N.C.
     A3 ⊏ 9                  82 ⊐ DW/W
     A4 ⊏ 10                 81 ⊐ OE
     A5 ⊏ 11                 80 ⊐ CE
    VCC ⊏ 12                 79 ⊐ GND
    DQ0 ⊏ 13                 78 ⊐ DQ31/A-1
   DQ16 ⊏ 14                 77 ⊐ DQ15
    DQ1 ⊏ 15                 76 ⊐ DQ30
   DQ17 ⊏ 16                 75 ⊐ DQ14
    GND ⊏ 17                 74 ⊐ GND
    VCC ⊏ 18                 73 ⊐ VCC
    DQ2 ⊏ 19                 72 ⊐ DQ29
   DQ18 ⊏ 20                 71 ⊐ DQ13
    DQ3 ⊏ 21                 70 ⊐ DQ28
   DQ19 ⊏ 22                 69 ⊐ DQ12
    DQ4 ⊏ 23                 68 ⊐ DQ27
   DQ20 ⊏ 24                 67 ⊐ DQ11
    DQ5 ⊏ 25                 66 ⊐ DQ26
   DQ21 ⊏ 26                 65 ⊐ DQ10
    GND ⊏ 27                 64 ⊐ GND
    VCC ⊏ 28                 63 ⊐ VCC
    DQ6 ⊏ 29                 62 ⊐ DQ25
   DQ22 ⊏ 30                 61 ⊐ DQ9
    DQ7 ⊏ 31                 60 ⊐ DQ24
   DQ23 ⊏ 32                 59 ⊐ DQ8
    GND ⊏ 33                 58 ⊐ VCC
     A6 ⊏ 34                 57 ⊐ A19
     A7 ⊏ 35                 56 ⊐ A18
     A8 ⊏ 36                 55 ⊐ A17
     A9 ⊏ 37                 54 ⊐ A16
    A10 ⊏ 38                 53 ⊐ A15
    A11 ⊏ 39                 52 ⊐ A14
    A12 ⊏ 40                 51 ⊐ A13
    N.C. ⊏ 41                50 ⊐ N.C.
    N.C. ⊏ 42                49 ⊐ N.C.
    N.C. ⊏ 43                48 ⊐ N.C.
    N.C. ⊏ 44                47 ⊐ N.C.
    N.C. ⊏ 45                46 ⊐ N.C.

                 FPT-90P-M01
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                    FBGA
                  (top view)
                 Marking Side

  (B9)  (C9)  (D9)  (E9)  (F9)  (G9)  (H9)  (J9)
  DQ30  VCC   DQ13  DQ12  DQ27  DQ26  VCC   DQ9
(A8)(B8)  (C8)  (D8)  (E8)  (F8)  (G8)  (H8)  (J8)(K8)
CE  VSS   DQ15  DQ29  DQ28  DQ11  VSS   DQ24  VCC  A19
(A7)(B7)  (C7)  (D7)  (E7)  (F7)  (G7)  (H7)  (J7)(K7)
N.C. DW/W  OE   DQ14  VSS   DQ10  DQ25  A18   A17  A16
(A6)(B6)  (C6)  (D6)  (E6)  (F6)  (G6)  (H6)  (J6)(K6)
WE  N.C.  N.C. DQ31/A-1 N.C. N.C. DQ8  A15   A14  A13
(A5)(B5)  (C5)  (D5)  (E5)  (F5)  (G5)  (H5)  (J5)(K5)
N.C. ACC  WP   N.C.  N.C.  N.C.  N.C.  N.C.  N.C.  N.C.
(A4)(B4)  (C4)  (D4)  (E4)  (F4)  (G4)  (H4)  (J4)(K4)
A1  A2    A3    A0   DQ2   N.C.  A12   A11   A9   A10
(A3)(B3)  (C3)  (D3)  (E3)  (F3)  (G3)  (H3)  (J3)(K3)
A4  A5    DQ0   DQ16  DQ18  DQ5   DQ21  A8    A6   A7
  (B2)  (C2)  (D2)  (E2)  (F2)  (G2)  (H2)  (J2)(K2)
  VCC   DQ1   VSS   DQ19  DQ4   DQ6   DQ7   DQ23  VSS
        (C1)  (D1)  (E1)  (F1)  (G1)  (H1)  (J1)
        DQ17  VCC   DQ3   DQ20  VSS   VCC   DQ22

                 BGA-84P-M01
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Product Applications

The following are sample applications for the 32 M-bit page mode flash memory:

• Systems requiring high-performance, multi-function, high-density flash memories

• Higher speed memories for high-performance x32-/x64-bit microcontrollers

• Systems requiring programming or code updates

Future Development

This article has introduced a new product, the MBM29PL3200TE/BE, primarily as a solution for high-speed, high-performance laser printers and car navigation systems. In the future, FUJITSU plans to continue to expand our family of high-performance, advanced-function, high-density products to meet the demands of our customers. ◆
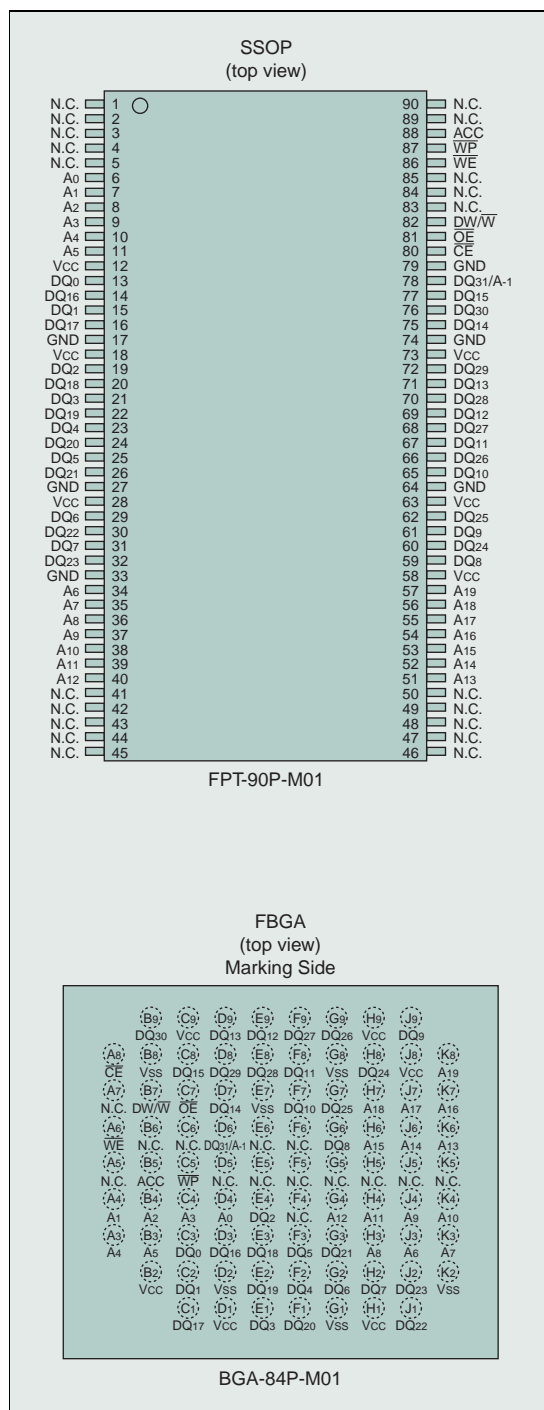
Table 1.   Top Boot-Block Model Sector Configuration (MBM29PL3200TE)

Sector	Sector Size (word/double word)	(x16) Address Range	(x32) Address Range
SA0	128/64	000000h to 01FFFFh	00000h to 0FFFFh
SA1	128/64	020000h to 03FFFFh	10000h to 1FFFFh
SA2	128/64	040000h to 05FFFFh	20000h to 2FFFFh
SA3	128/64	060000h to 07FFFFh	30000h to 3FFFFh
SA4	128/64	080000h to 09FFFFh	40000h to 4FFFFh
SA5	128/64	0A0000h to 0BFFFFh	50000h to 5FFFFh
SA6	128/64	0C0000h to 0DFFFFh	60000h to 6FFFFh
SA7	128/64	0E0000h to 0FFFFFh	70000h to 7FFFFh
SA8	128/64	100000h to 11FFFFh	80000h to 8FFFFh
SA9	128/64	120000h to 13FFFFh	90000h to 9FFFFh
SA10	128/64	140000h to 15FFFFh	A0000h to AFFFFh
SA11	128/64	160000h to 17FFFFh	B0000h to BFFFFh
SA12	128/64	180000h to 19FFFFh	C0000h to CFFFFh
SA13	128/64	1A0000h to 1BFFFFh	D0000h to DFFFFh
SA14	128/64	1C0000h to 1DFFFFh	E0000h to EFFFFh
SA15	96/48	1E0000h to 1F7FFFh	F0000h to FBFFFh
SA16	8/4	1F8000h to 1F9FFFh	FC000h to FDFFFh
SA17	8/4	1FA000h to 1FBFFFh	FD000h to FEFFFh
SA18	16/8	1FC000h to 1FFFFh	FE000h to FFFFFh

Note: Word mode (DW/$\overline{W}$ = V_{IL}) uses pins A19-A $_{-1}$, and double-word mode (DW/$\overline{W}$ = V_{IH}) uses A19-A0.

Table 2.   Top Boot-Block Model Sector Configuration (MBM29PL3200BE)

Sector	Sector Size (word/double word)	(x16) Address Range	(x32) Address Range
SA0	16/8	000000h to 003FFFh	00000h to 01FFFh
SA1	8/4	004000h to 005FFFh	02000h to 02FFFh
SA2	8/4	006000h to 007FFFh	03000h to 03FFFh
SA3	96/48	008000h to 01FFFFh	04000h to 0FFFFh
SA4	128/64	020000h to 03FFFFh	10000h to 1FFFFh
SA5	128/64	040000h to 05FFFFh	20000h to 2FFFFh
SA6	128/64	060000h to 07FFFFh	30000h to 3FFFFh
SA7	128/64	080000h to 09FFFFh	40000h to 4FFFFh
SA8	128/64	0A0000h to 0BFFFFh	50000h to 5FFFFh
SA9	128/64	0C0000h to 0DFFFFh	60000h to 6FFFFh
SA10	128/64	0E0000h to 0FFFFFh	70000h to 7FFFFh
SA11	128/64	100000h to 11FFFFh	80000h to 8FFFFh
SA12	128/64	120000h to 13FFFFh	90000h to 9FFFFh
SA13	128/64	140000h to 15FFFFh	A0000h to AFFFFh
SA14	128/64	160000h to 17FFFFh	B0000h to BFFFFh
SA15	128/64	180000h to 19FFFFh	C0000h to CFFFFh
SA16	128/64	1A0000h to 1BFFFFh	D0000h to DFFFFh
SA17	128/64	1C0000h to 1DFFFFh	E0000h to EFFFFh
SA18	128/64	1E0000h to 1FFFFFh	F0000h to FFFFFh

Note: Word mode ($DW/\overline{W}=V_{IL}$) uses pins A19-A$_{-1}$, and double-word mode ($DW/\overline{W} = V_{IH}$) uses A19-A0.

Table 3.   MBM29PL3200TE/BE Product Performance

Model			MBM29PL3200TE 70/90	MBM29PL3200BE 70/90
Access Time (max.)	Random		70 ns/90 ns	
	Page		25 ns/35 ns	
Power Supply Voltage			2.7V to 3.6V (3.0V to 3.6V)	
Power Consumption (max.)	Read	Word	240 mW	
		Double Word	240 mW	
	Erase/Program		240 mW	
	CMOS Standby		18 µW	
Erase Time (typ.)			4 s	
Program Time (typ.)	Word		14.3 µs	
	Double Word		18.3 µs	
Boot Block			Top	Bottom
Package			SSOP-90, FBGA-84	