Memory FRAM

CMOS

256 K (32 K × 8) Bit

MB85R256H

■ DESCRIPTIONS

The MB85R256H is an FRAM (Ferroelectric Random Access Memory) chip in a configuration of 32,768 words x 8 bits, using the ferroelectric process and silicon gate CMOS process technologies for forming the nonvolatile memory cells.

The MB85R256H is able to retain data without using a back-up battery, as is needed for SRAM.

The memory cells used in the MB85R256H can be used for 10^{10} read/write operations, which is a significant improvement over the number of read and write operations supported by Flash memory and E^2PROM.

The MB85R256H uses a pseudo - SRAM interface compatible with conventional asynchronous SRAM.
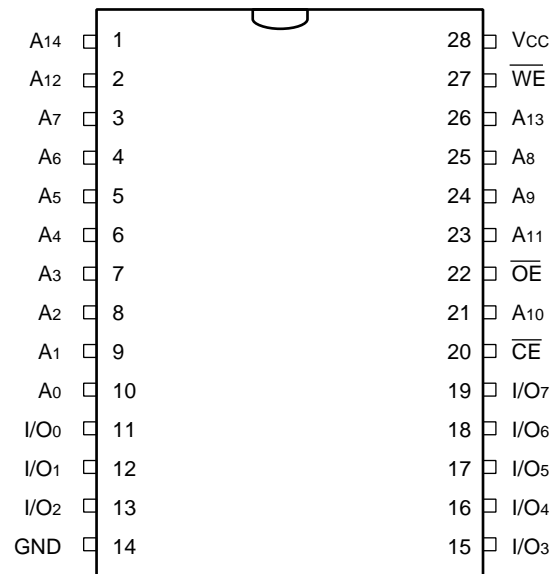
■ FEATURES

• Bit configuration : 32,768 words x 8 bits
• High endurance 10 Billion Read/writes
• Peripheral circuit CMOS construction
• Operating power supply voltage : 2.7 V to 3.6 V
• Operating temperature range   : -40 °C to $+85$ °C
• Data retention   : 10 years ($+70$ °C)
• Package   : 28-pin, SOP flat package
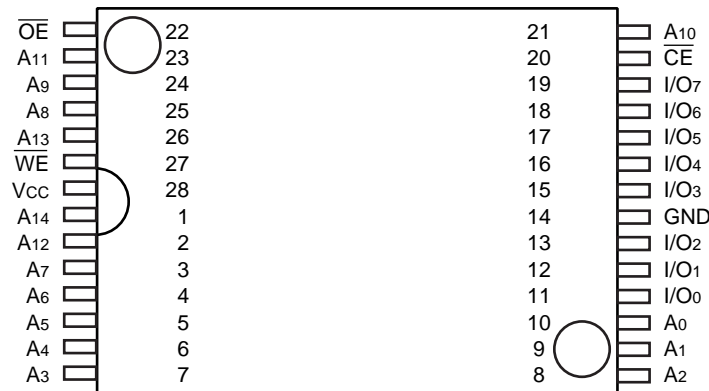   : 28-pin, TSOP(1) flat package

■ PIN ASSIGNMENTS

(TOP VIEW)

A_{14}	1	28	V_{CC}
A_{12}	2	27	$\overline{WE}$
A_7	3	26	A_{13}
A_6	4	25	A_8
A_5	5	24	A_9
A_4	6	23	A_{11}
A_3	7	22	$\overline{OE}$
A_2	8	21	A_{10}
A_1	9	20	$\overline{CE}$
A_0	10	19	I/O_7
I/O_0	11	18	I/O_6
I/O_1	12	17	I/O_5
I/O_2	13	16	I/O_4
GND	14	15	I/O_3

(FPT-28P-M17)

$\overline{OE}$	22	21	A_{10}
A_{11}	23	20	$\overline{CE}$
A_9	24	19	I/O_7
A_8	25	18	I/O_6
A_{13}	26	17	I/O_5
$\overline{WE}$	27	16	I/O_4
V_{CC}	28	15	I/O_3
A_{14}	1	14	GND
A_{12}	2	13	I/O_2
A_7	3	12	I/O_1
A_6	4	11	I/O_0
A_5	5	10	A_0
A_4	6	9	A_1
A_3	7	8	A_2

(FPT-28P-M19)

■ PIN FUNCTIONAL DESCRIPTIONS

Pin no.	Pin name	Functional description
1 to 10, 21, 23 to 26	A_0 to A_{14}	Address input
11 to 13, 15 to 19	I/O_0 to I/O_7	Data input/output
20	$\overline{CE}$	Chip enable input
27	$\overline{WE}$	Write Enable input
22	$\overline{OE}$	Output enable input
28	V_{CC}	Power supply (+ 3.3 V Typ)
14	GND	Ground

■ BLOCK DIAGRAM
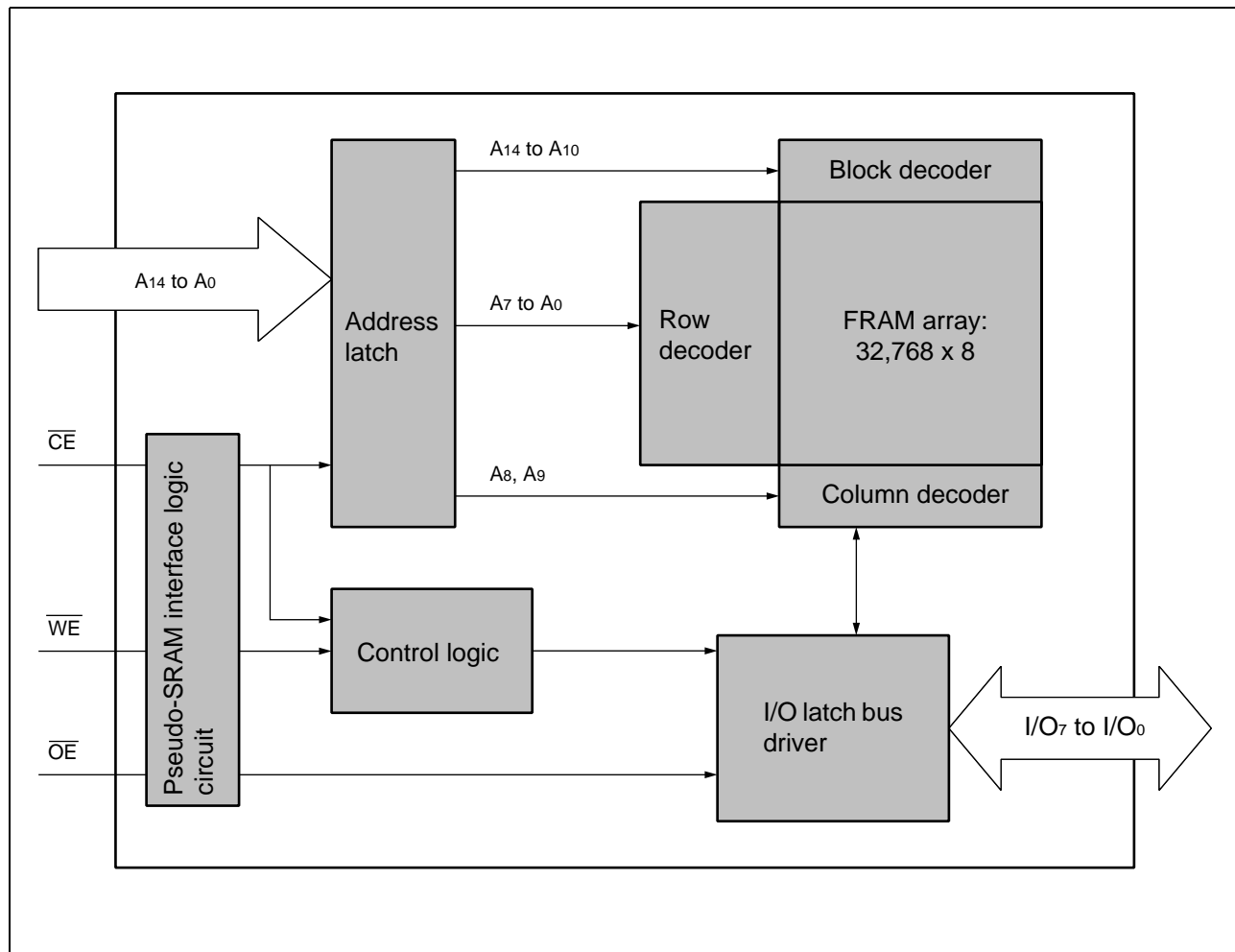
■ FUNCTION LIST

Operation mode	$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	I/O$_7$ to I/O$_0$	Power supply current
Standby precharge	H	×	×	High-Z	Standby (I_{SB})
	×	L	L		
	×	H	H		
Latch address	L	⎍	⎍	—	—
Write	L	L	H	Data input	Operation (I_{CC})
Read	L	H	L	Data output	

H: High level, L: Low level, × : Irrespective of "H" or "L"

FUJITSU

■ **ABSOLUTE MAXIMUM RANGES**

Parameter	Symbol	Rating		Unit
		Min	Max	
Power supply voltage	V_{CC}	− 0.5	+ 4.0	V
Input voltage	V_{IN}	− 0.5	V_{CC} + 0.5	V
Output voltage	V_{OUT}	− 0.5	V_{CC} + 0.5	V
Operating temperature	T_A	− 40	+ 85	°C
Storage temperature	Tstg	− 40	+ 125	°C

WARNING: Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.

■ **RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Power supply voltage	V_{CC}	2.7	3.3	3.6	V
High level input voltage	V_{IH}	$V_{CC} \times 0.8$	—	V_{CC} + 0.5	V
Low level input voltage	V_{IL}	− 0.5	—	+ 0.6	V
Operating temperature	T_A	− 40	—	+ 85	°C

WARNING: The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device's electrical characteristics are warranted when the device is operated within these ranges.

Always use semiconductor devices within their recommended operating condition ranges. Operation outside these ranges may adversely affect reliability and could result in device failure.

No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their representatives beforehand.

■ ELECTRICAL CHARACTERISTICS

1. DC Characteristics

(within recommended operating conditions)

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Input leakage current	| I_{LI} |	V_{IN} = 0 V to V_{CC}	—	—	10	μA
Output leakage current	| I_{LO} |	V_{OUT} = 0 V to V_{CC}, $\overline{CE}$ = V_{IH} or $\overline{OE}$ = V_{IH}	—	—	10	μA
Operating power supply current	I_{CC}	$\overline{CE}$ = 0.2 V, Other inputs = V_{CC} – 0.2 V/0.2 V, t_{RC} (Min), Ii/o = 0 mA	—	5	10	mA
Standby current	I_{SB}	$\overline{CE}$, $\overline{WE}$, $\overline{OE}$ ≥ V_{CC}	—	5	50	μA
High level output voltage	V_{OH}	I_{OH} = – 2.0 mA	V_{CC} × 0.8	—	—	V
Low level output voltage	V_{OL}	I_{OL} = 2.0 mA	—	—	0.4	V

2. AC Characteristics

(1) Read cycle

(within recommended operating conditions)

Parameter	Symbol	Value		Unit
		Min	Max	
Read cycle time	t_{RC}	150	—	ns
$\overline{CE}$ active time	t_{CA}	70	2000	
Read pulse width	t_{RP}	70	2000	
Precharge time	t_{PC}	80	—	
Address setup time	t_{AS}	0	—	
Address hold time	t_{AH}	25	—	
$\overline{CE}$ access time	t_{CE}	—	70	
$\overline{OE}$ access time	t_{OE}	—	70	
$\overline{CE}$ output floating time	t_{HZ}	—	25	
$\overline{OE}$ output floating time	t_{OHZ}	—	25	

(2) Write cycle

(within recommended operating conditions)

Parameter	Symbol	Value		Unit
		Min	Max	
Write cycle time	t_{WC}	150	—	ns
$\overline{CE}$ active time	t_{CA}	70	2000	
Write pulse width	t_{WP}	70	2000	
Precharge time	t_{PC}	80	—	
Address setup time	t_{AS}	0	—	
Address hold time	t_{AH}	25	—	
Data setup time	t_{DS}	50	—	
Data hold time	t_{DH}	0	—	
Write set up time	t_{WS}	0	—	
Write hold time	t_{WH}	0	—	

3. Pin Capacitance

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Input capacitance	C_{IN}	$V_{IN} = V_{OUT} = GND$, $f = 1$ MHz, $T_A = +25\,°C$	—	—	10	pF
Output capacitance	C_{OUT}		—	—	10	pF

4. AC Characteristics Test Condition

Power supply voltage : 2.7 V to 3.6 V

Input voltage amplitude : 0.3 V to 2.7 V

Input rising time : 10 ns

Input falling time : 10 ns

Input evaluation level : 2.0 V/0.8 V

Output evaluation level : 2.0 V/0.8 V

Output load : 100 pF

■ TIMING DIAGRAM

1. Read cycle ($\overline{CE}$ Control)
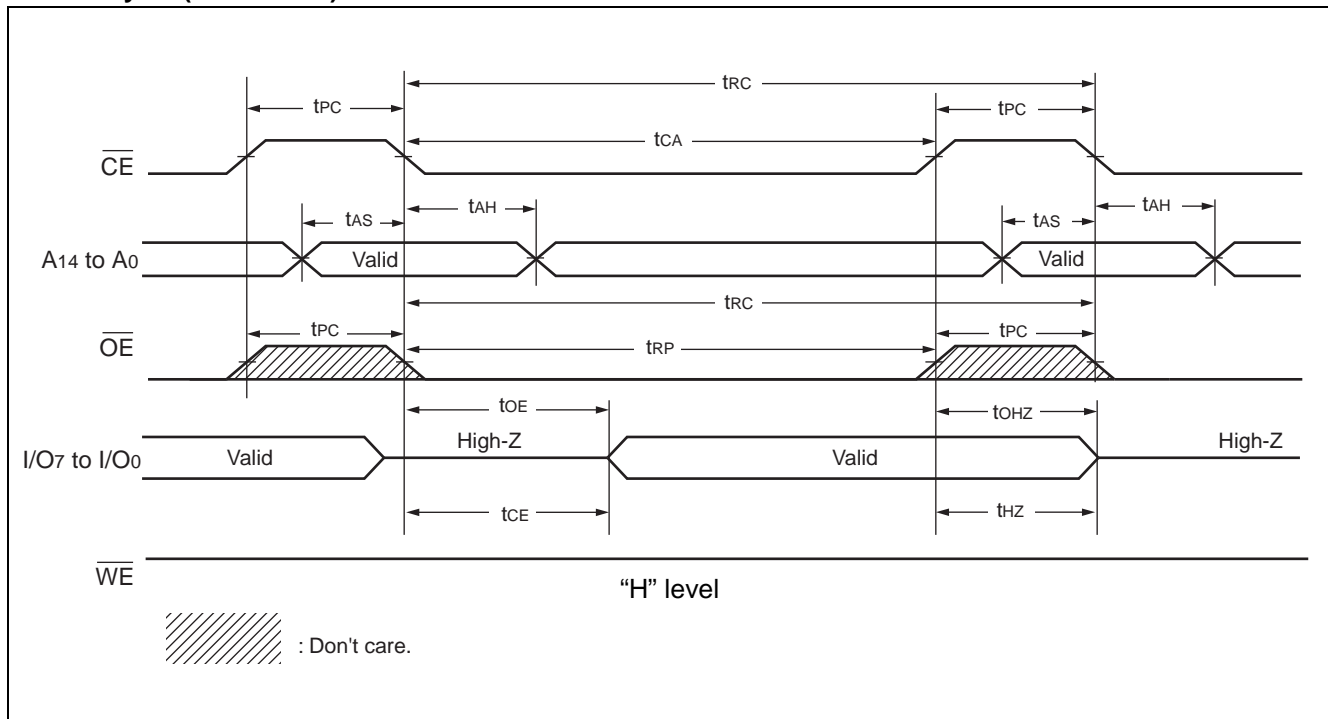
2. Read cycle ($\overline{OE}$ Control)
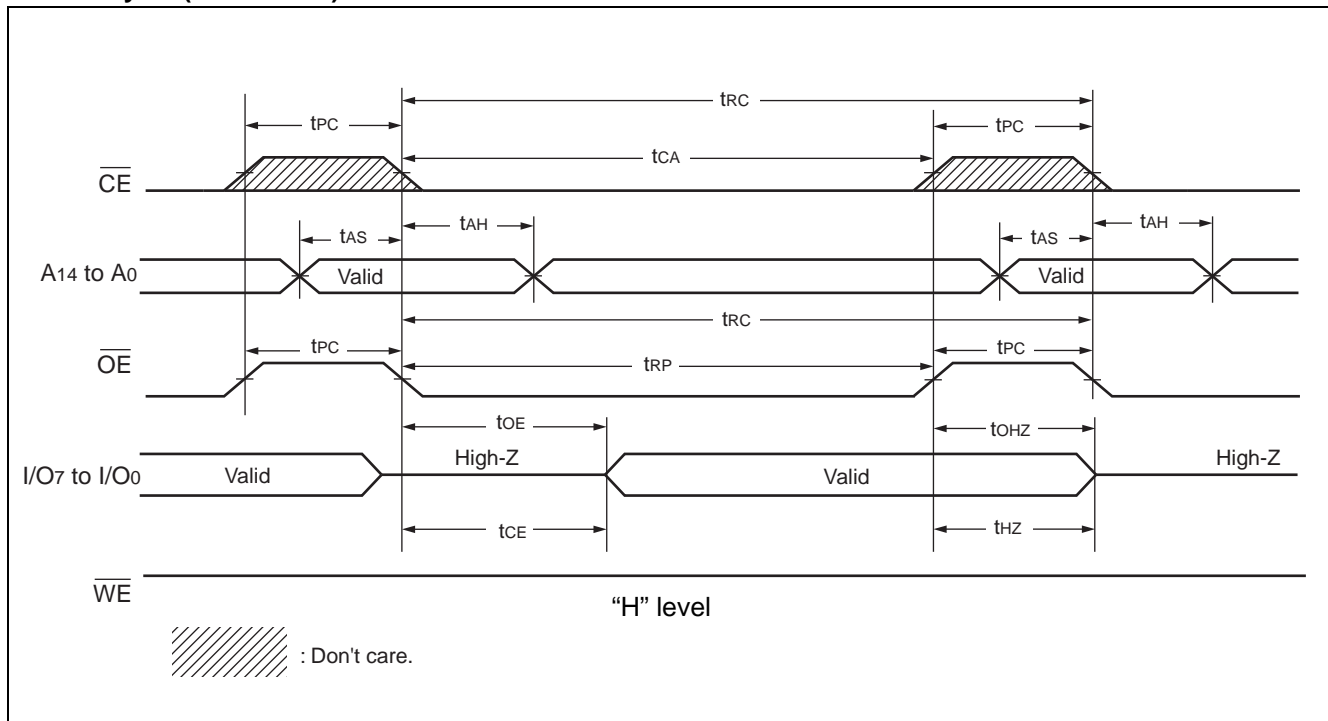
3. Write cycle ($\overline{CE}$ Control)
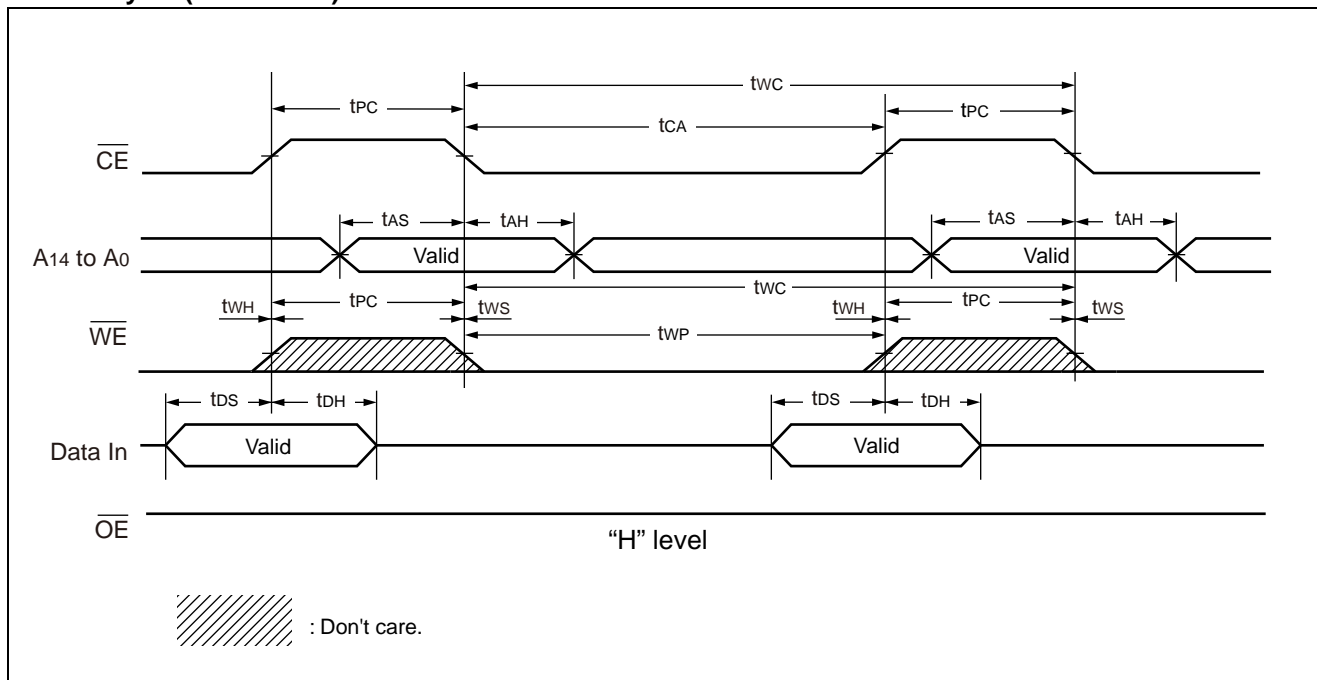
4. Write cycle ($\overline{WE}$ Control)

■ **POWER ON/OFF SEQUENCE**

* : $\overline{\text{CE}}$ (Max) < Vcc + 0.5 V
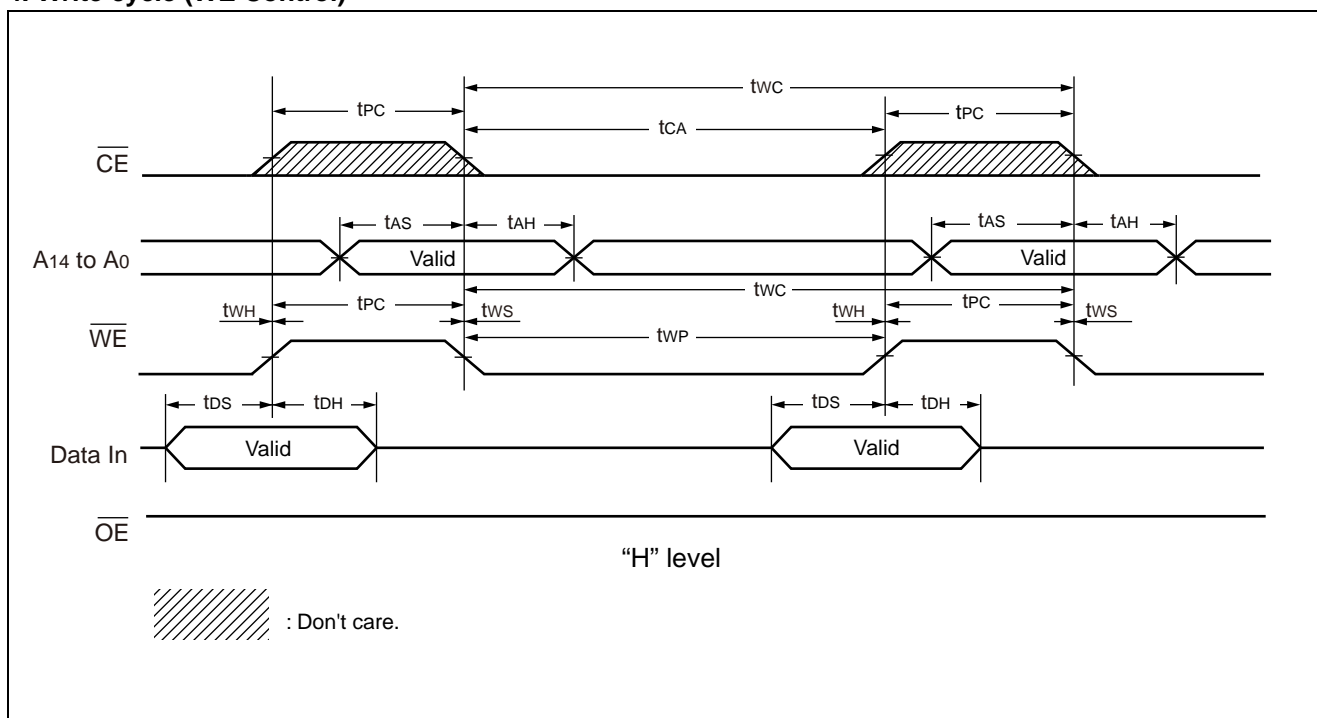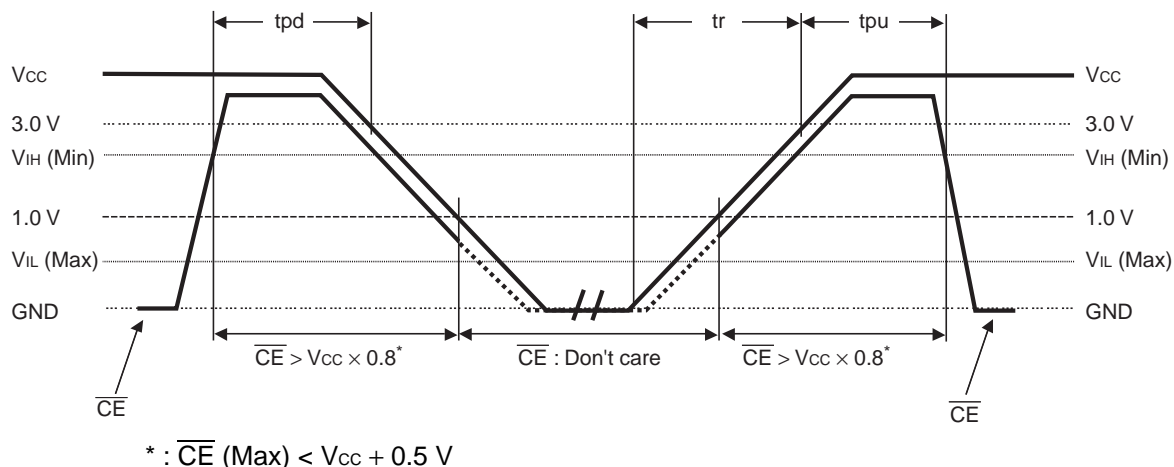
Notes: • Because turning the power-on from an intermediate level cause malfunction, when the power is turned on, Vcc is required to be started from 0 V.

• If the device does not operate within the specified conditions of read cycle, write cycle, power on/off sequence, memory data can not be guaranteed.

(within recommended operating conditions)

Parameter	Symbol	Value			Unit
		Min	**Typ**	**Max**	
$\overline{\text{CE}}$ level hold time at power OFF	tpd	80	—	—	ns
$\overline{\text{CE}}$ level hold time at power ON	tpu	80	—	—	ns
Power supply rising time	tr	0.05	—	200	ms
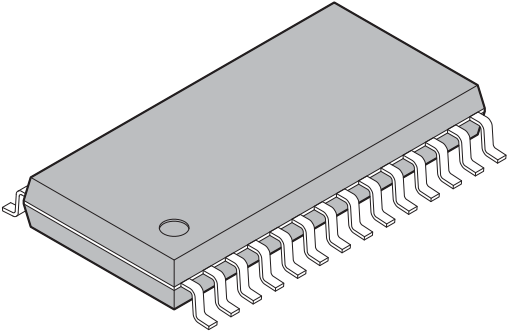
■ **NOTES ON USE**

After the IR reflow completed, it is not guaranteed to save the data written prior to the IR reflow.

■ **ORDERING INFORMATION**

Part number	Package	Remarks
MB85R256HPF-G-BNDAE1	28-pin plastic SOP (FPT-28P-M17)	
MB85R256HPFCN-G-BNDAE1	28-pin plastic TSOP(1) (FPT-28P-M19)	
MB85R256HPF-G-BND-ERAE1	28-pin plastic SOP (FPT-28P-M17)	Embossed carrier tape

FUJITSU

■ PACKAGE DIMENSIONS

28-pin plastic SOP	Lead pitch	1.27 mm
	Package width × package length	8.6 × 17.75 mm
	Lead shape	Gullwing
	Sealing method	Plastic mold
	Mounting height	2.80 mm MAX
	Weight	0.82 g
(FPT-28P-M17)	Code (Reference)	P-SOP28-8.6×17.75-1.27

28-pin plastic SOP
(FPT-28P-M17)

Note 1) *1 : These dimensions include resin protrusion.
Note 2) *2 : These dimensions do not include resin protrusion.
Note 3) Pins width and pins thickness include plating thickness.
Note 4) Pins width do not include tie bar cutting remainder.

*1 17.75 $^{+0.25}_{-0.20}$ (.699 $^{+.010}_{-.008}$)

0.17 $^{+0.03}_{-0.04}$
(.007 $^{+.001}_{-.002}$)

28

15

11.80±0.30
(.465±.012)

*2 8.60±0.20
(.339±.008)

INDEX

Details of "A" part

2.65±0.15
(.104±.006) (Mounting height)

0.25(.010)

0~8°

1

14

0.80±0.20
(.031±.008)

0.20±0.15
(.008±.006)
(Stand off)

0.88±0.15
(.035±.006)

1.27(.050)

0.47±0.08
(.019±.003)

⊕ 0.13(.005) Ⓜ

"A"

0.10(.004)

© 2002-2008 FUJITSU MICROELECTRONICS LIMITED F28048S-c-3-5

Dimensions in mm (inches).
Note: The values in parentheses are reference values.

Please confirm the latest Package dimension by following URL.
http://edevice.fujitsu.com/package/en-search/

(Continued)

(Continued)

28-pin plastic TSOP (1)	Lead pitch	0.55 mm
	Package width × package length	11.80 × 8.00 mm
	Lead shape	Gullwing
	Sealing method	Plastic mold
	Mounting height	1.20 mm Max
	Weight	Approx. 0.25 g
(FPT-28P-M19)	Code (Reference)	P-TSOP(1)28-11.8×8-0.55

28-pin plastic TSOP (1)
    (FPT-28P-M19)

0.15±0.05
(.006±.002)

13.40±0.20
(.528±.008)
11.80±0.20
(.465±.008)

0.10(.004)

12.40±0.20
(.488±.008)

0.50±0.10
(.020±.004)

0.00(.000) Min
(Stand off)

8.00±0.20
(.315±.008)

$1.10^{+0.10}_{-0.05}$ ($.043^{+.004}_{-.002}$)
(Mounting height)

0.55(.0217)
TYP

7.15(.281)
REF

0.20±0.10
(.008±.004)

0.09(.004) Ⓜ
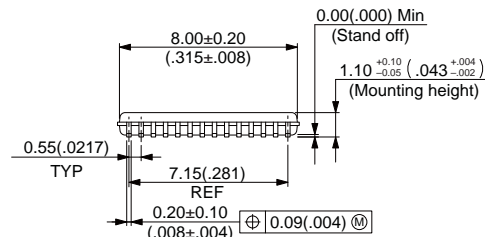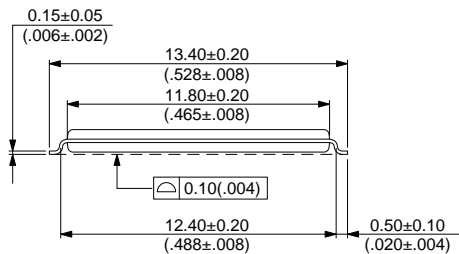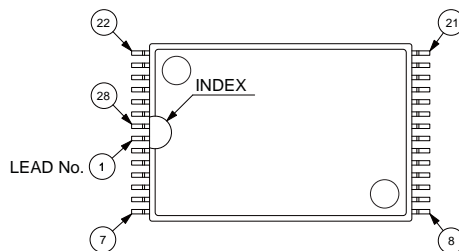
©2005-2008 FUJITSU MICROELECTRONICS LIMITED F28062S-c-3-4

Dimensions in mm (inches).
Note: The values in parentheses are reference values.

Please confirm the latest Package dimension by following URL.
http://edevice.fujitsu.com/package/en-search/

MEMO

MEMO

FUJITSU

MEMO

FUJITSU MICROELECTRONICS LIMITED

Shinjuku Dai-Ichi Seimei Bldg., 7-1, Nishishinjuku 2-chome,
Shinjuku-ku, Tokyo 163-0722, Japan
Tel: +81-3-5322-3329
http://jp.fujitsu.com/fml/en/

For further information please contact:

North and South America
FUJITSU MICROELECTRONICS AMERICA, INC.
1250 E. Arques Avenue, M/S 333
Sunnyvale, CA 94085-5401, U.S.A.
Tel: +1-408-737-5600   Fax: +1-408-737-5999
http://www.fma.fujitsu.com/

Europe
FUJITSU MICROELECTRONICS EUROPE GmbH
Pittlerstrasse 47, 63225 Langen, Germany
Tel: +49-6103-690-0 Fax: +49-6103-690-122
http://emea.fujitsu.com/microelectronics/

Korea
FUJITSU MICROELECTRONICS KOREA LTD.
206 Kosmo Tower Building, 1002 Daechi-Dong,
Gangnam-Gu, Seoul 135-280, Republic of Korea
Tel: +82-2-3484-7100 Fax: +82-2-3484-7111
http://kr.fujitsu.com/fmk/

Asia Pacific
FUJITSU MICROELECTRONICS ASIA PTE. LTD.
151 Lorong Chuan,
#05-08 New Tech Park 556741 Singapore
Tel : +65-6281-0770 Fax : +65-6281-0220
http://www.fmal.fujitsu.com/

FUJITSU MICROELECTRONICS SHANGHAI CO., LTD.
Rm. 3102, Bund Center, No.222 Yan An Road (E),
Shanghai 200002, China
Tel : +86-21-6146-3688 Fax : +86-21-6335-1605
http://cn.fujitsu.com/fmc/

FUJITSU MICROELECTRONICS PACIFIC ASIA LTD.
10/F., World Commerce Centre, 11 Canton Road,
Tsimshatsui, Kowloon, Hong Kong
Tel : +852-2377-0226 Fax : +852-2376-3269
http://cn.fujitsu.com/fmc/en/

Edited: Sales Promotion Department