

# *Memory FRAM*

## 256 K (32 K × 8) Bit

# MB85R256F

### ■ DESCRIPTIONS

The MB85R256F is an FRAM (Ferroelectric Random Access Memory) chip in a configuration of 32,768 words × 8 bits, using the ferroelectric process and silicon gate CMOS process technologies for forming the nonvolatile memory cells.

The MB85R256F is able to retain data without using a back-up battery, as is needed for SRAM.

The memory cells used in the MB85R256F 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<sup>2</sup>PROM.

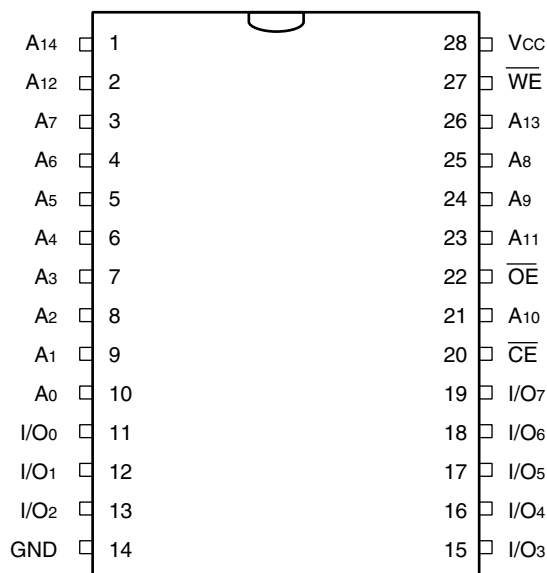
The MB85R256F uses a pseudo - SRAM interface compatible with conventional asynchronous SRAM.

### ■ FEATURES

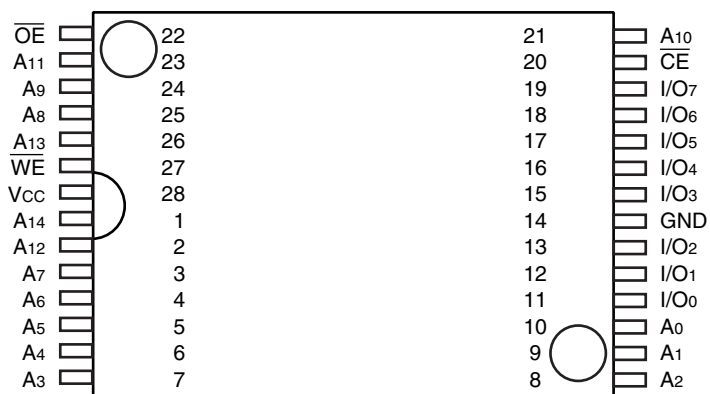
- Bit configuration : 32,768 words × 8 bits
- High endurance 10 Billion Read/writes
- Peripheral circuit CMOS construction
- Operating power supply voltage : 2.7 V to 3.6 V
- Operating temperature range : -40 °C to +85 °C
- Data retention : 10 years (+55 °C)
- Package : 28-pin, SOP flat package  
: 28-pin, TSOP(1) flat package

## PIN ASSIGNMENTS

(TOP VIEW)



(FPT-28P-M17)

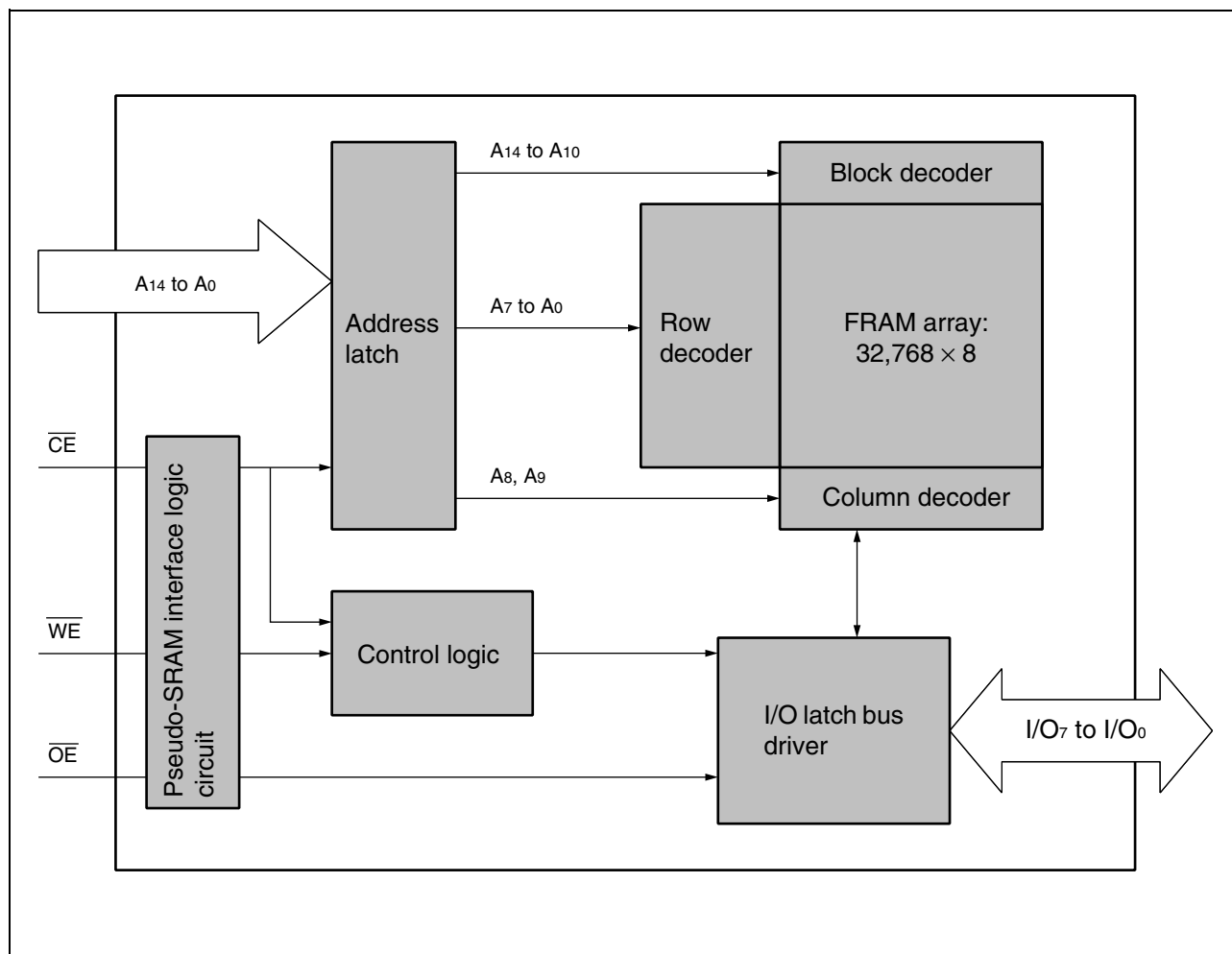


(FPT-28P-M19)

## ■ PIN FUNCTIONAL DESCRIPTIONS

Pin no.	Pin name	Functional description
1 to 10, 21, 23 to 26	A <sub>0</sub> to A <sub>14</sub>	Address input
11 to 13, 15 to 19	I/O <sub>0</sub> to I/O <sub>7</sub>	Data input/output
20	$\overline{CE}$	Chip enable input
27	$\overline{WE}$	Write Enable input
22	$\overline{OE}$	Output enable input
28	V <sub>CC</sub>	Power supply ( + 3.3 V Typ)
14	GND	Ground

## ■ BLOCK DIAGRAM



## ■ FUNCTION LIST

Operation mode	$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	I/O <sub>0</sub> to I/O <sub>7</sub>	Power supply current
Standby precharge	H	×	×	Hi-Z	Standby (I <sub>SB</sub> )
	×	L	L		
	×	H	H		
Latch address	L	$\overline{L}$	$\overline{L}$	—	—
	$\overline{L}$	H	L		
	$\overline{L}$	L	H		
Write	L	L	H	Data input	Operation (I <sub>CC</sub> )
Read	L	H	L	Data output	

H: High level, L: Low level, × : Irrespective of “H” or “L”

## ■ 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	$T_{stg}$	- 40	+ 125	°C

\* : These parameters are based on the condition that  $V_{SS}$  is 0 V.

**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

\* : These parameters are based on the condition that  $V_{SS}$  is 0 V.

**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} $	$V_{IN} = 0\text{ V to }V_{CC}$	—	—	10	$\mu\text{A}$
Output leakage current	$ I_{LO} $	$V_{OUT} = 0\text{ V to }V_{CC}$ , $\overline{CE} = V_{IH}$ or $\overline{OE} = V_{IH}$	—	—	10	$\mu\text{A}$
Operating power supply current	$I_{CC}$	$\overline{CE} = 0.2\text{ V}$ , Other inputs = $V_{CC} - 0.2\text{ V}/0.2\text{ V}$ , $t_{RC}(\text{Min})$ , li/o = 0 mA	—	5	10	mA
Standby current	$I_{SB}$	$\overline{CE}, \overline{WE}, \overline{OE} \geq V_{CC}$	—	5	50	$\mu\text{A}$
High level output voltage	$V_{OH}$	$I_{OH} = -2.0\text{ mA}$	$V_{CC} \times 0.8$	—	—	V
Low level output voltage	$V_{OL}$	$I_{OL} = 2.0\text{ mA}$	—	—	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	500	
Read pulse width	$t_{RP}$	70	500	
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	500	
Write pulse width	$t_{WP}$	70	500	
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	$C_{IN}$	$V_{IN} = V_{OUT} = GND$ , $f = 1 \text{ MHz}$ , $T_A = +25 \text{ }^\circ\text{C}$	—	—	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

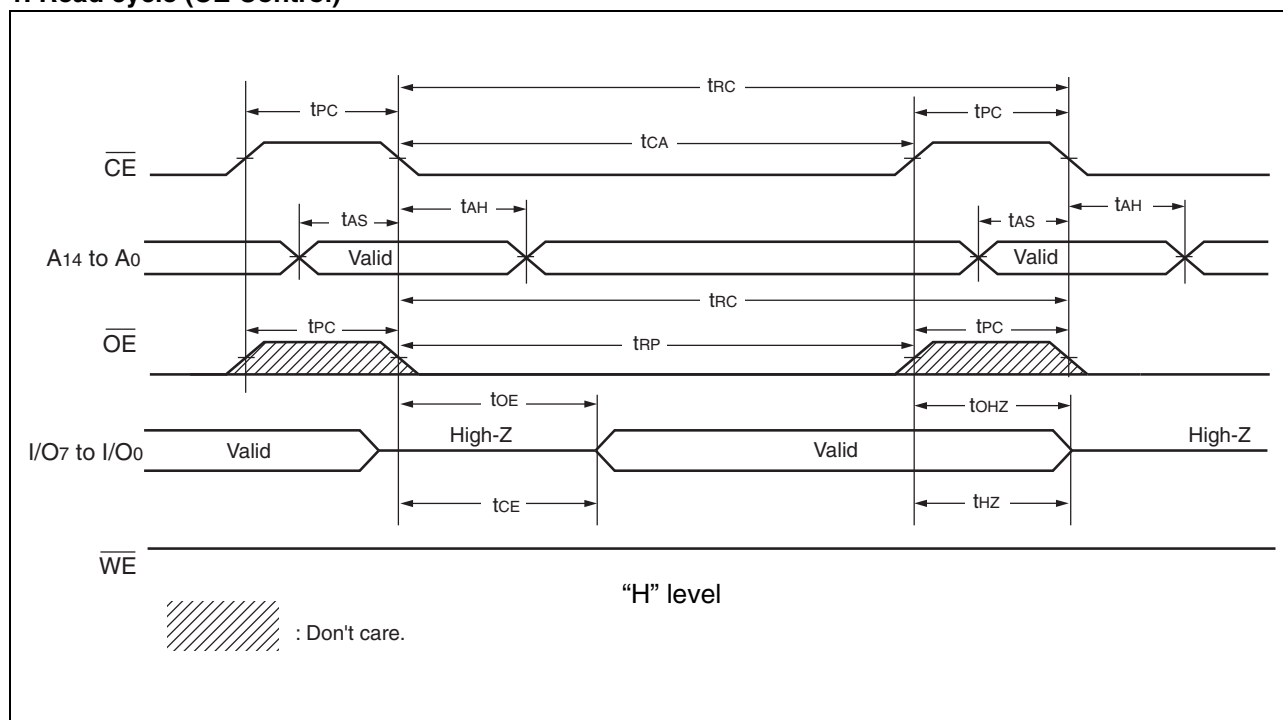
Input evaluation level:  $V_{CC}/2$

Output evaluation level:  $V_{CC}/2$

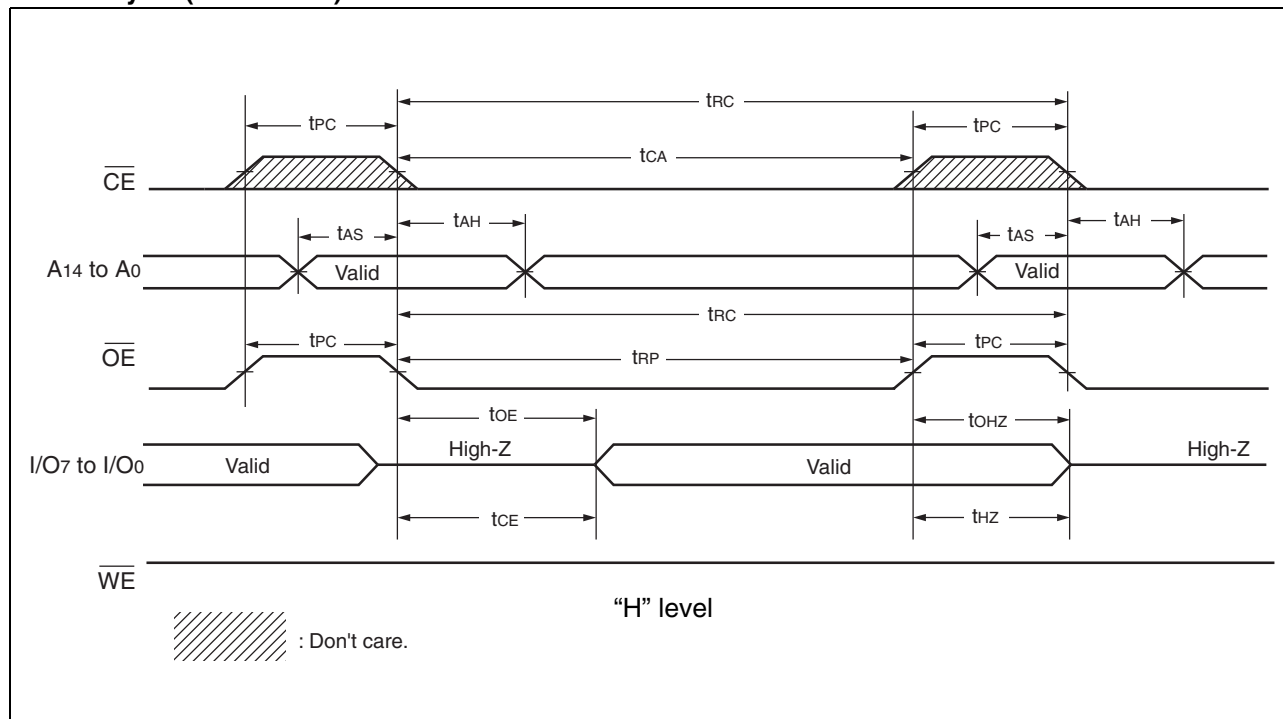
Output load: 100 pF

## ■ TIMING DIAGRAM

### 1. Read cycle ( $\overline{\text{CE}}$ Control)

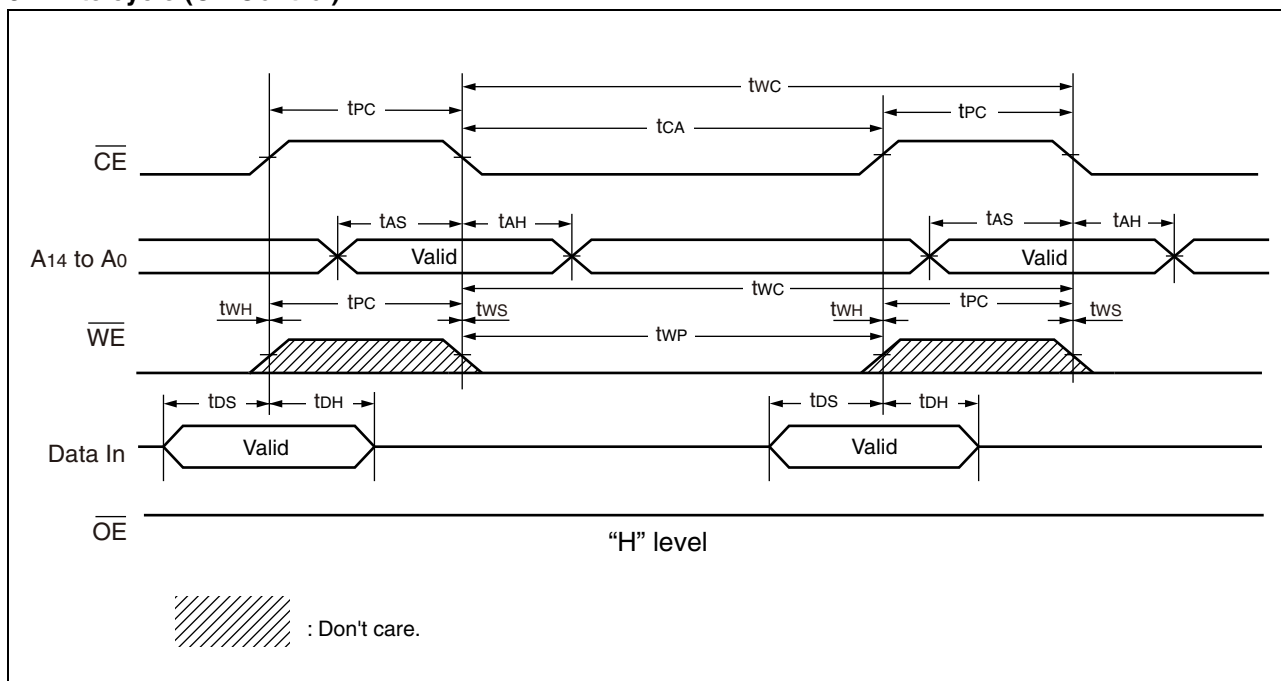


### 2. Read cycle ( $\overline{\text{OE}}$ Control)

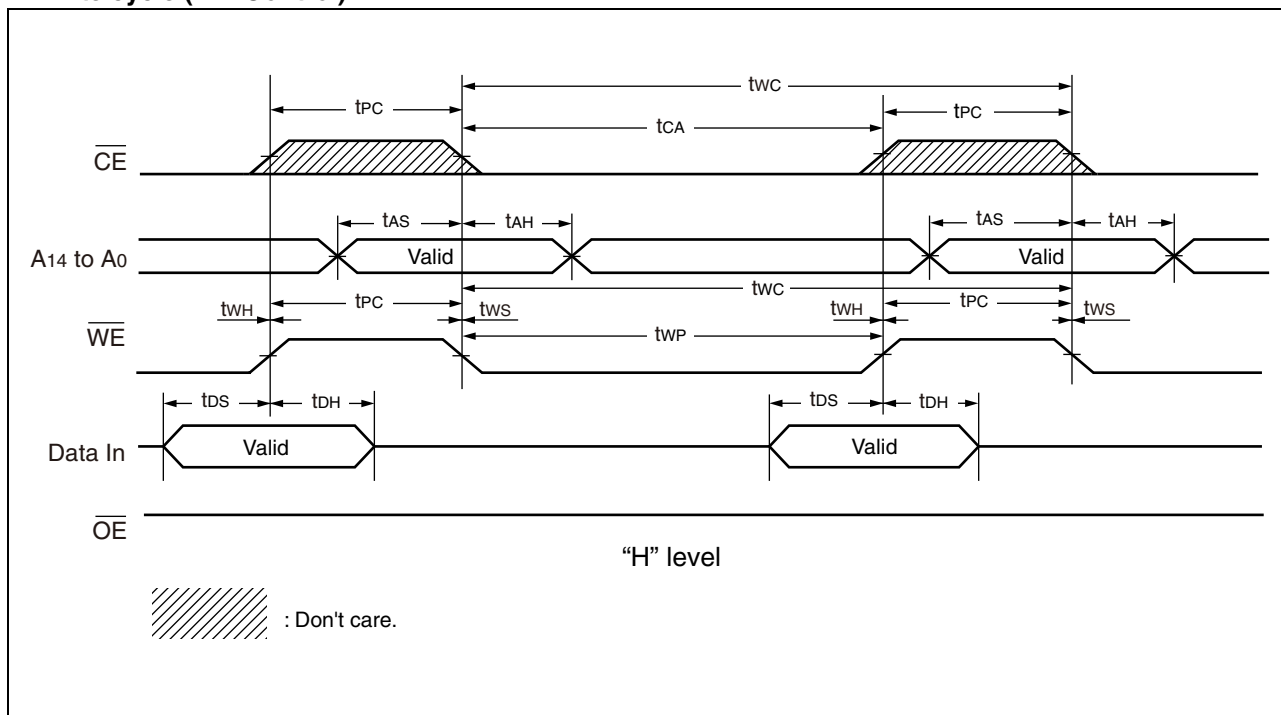




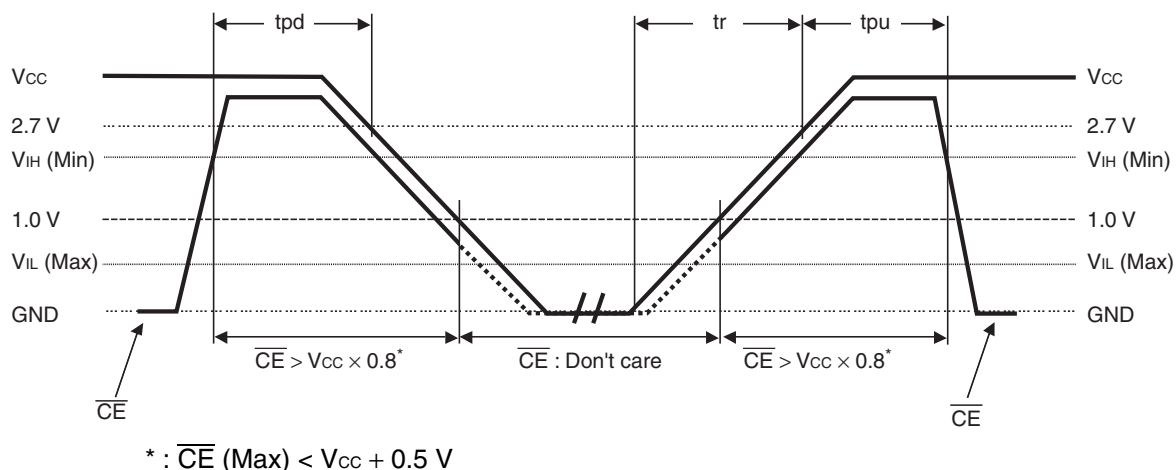
## 3. Write cycle ( $\overline{\text{CE}}$ Control)



## 4. Write cycle ( $\overline{\text{WE}}$ Control)



## ■ POWER ON/OFF SEQUENCE



- Notes:
- Because turning the power-on from an intermediate level cause malfunction, when the power is turned on,  $V_{CC}$  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	
$\overline{CE}$ level hold time at power OFF	$t_{pd}$	80	—	—	ns
$\overline{CE}$ level hold time at power ON	$t_{pu}$	80	—	—	ns
Power supply rising time	$t_r$	0.05	—	200	ms

## ■ NOTES ON USE

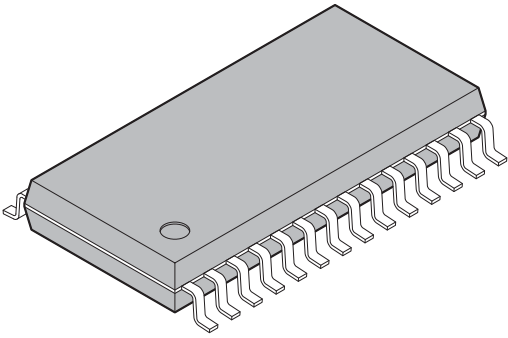
After the IR reflow completed, it is not guaranteed to save the data written prior to the IR reflow.

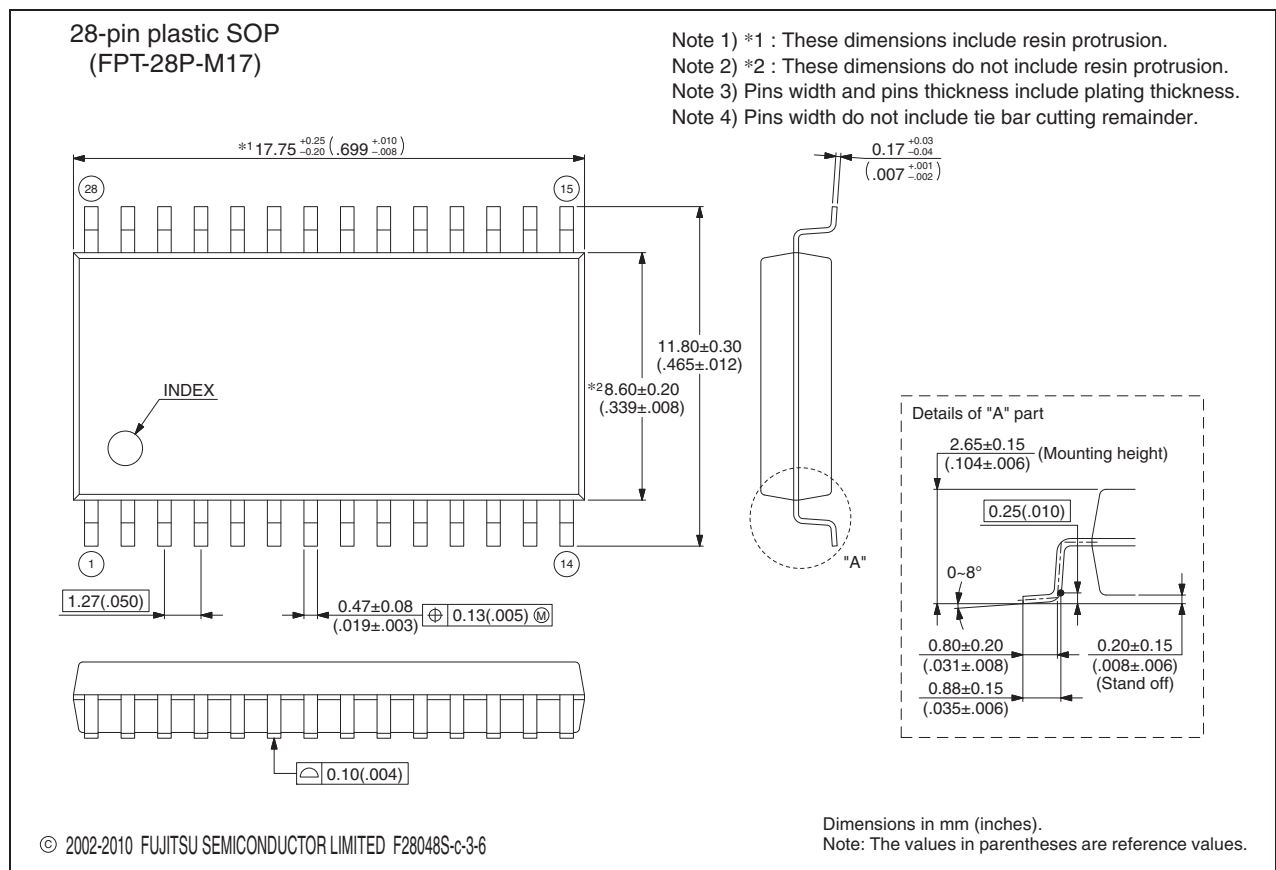
## ■ ORDERING INFORMATION

Part number	Package	Remarks
MB85R256FPF-G-BNDE1	28-pin plastic SOP (FPT-28P-M17)	
MB85R256FPFCN-G-BNDE1	28-pin plastic TSOP(1) (FPT-28P-M19)	
MB85R256FPF-G-BND-ERE1	28-pin plastic SOP (FPT-28P-M17)	Embossed carrier tape

# MB85R256F

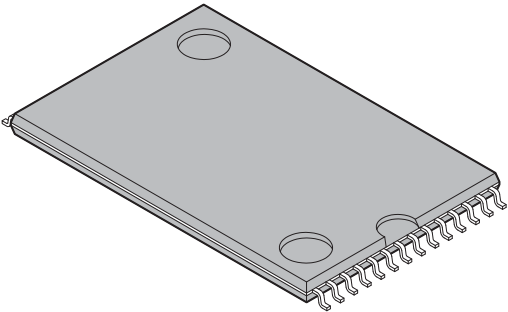
## ■ PACKAGE DIMENSIONS

<div>28-pin plastic SOP</div>  <div>(FPT-28P-M17)</div>	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
	Code (Reference)	P-SOP28-8.6×17.75-1.27

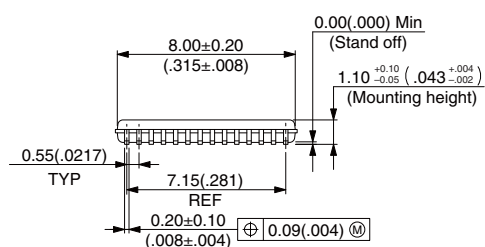
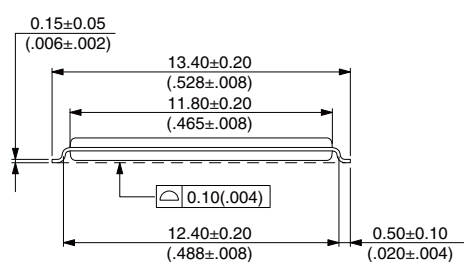
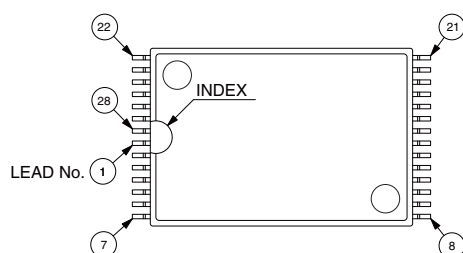


(Continued)

(Continued)

<p>28-pin plastic TSOP (1)</p>  <p>(FPT-28P-M19)</p>	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
	Code (Reference)	P-TSOP(1)28-11.8×8-0.55

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



© 2005-2010 FUJITSU SEMICONDUCTOR LIMITED F28062S-c-3-5

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

**MEMO**

**MEMO**

## FUJITSU SEMICONDUCTOR LIMITED

Nomura Fudosan Shin-yokohama Bldg. 10-23, Shin-yokohama 2-Chome,  
Kohoku-ku Yokohama Kanagawa 222-0033, Japan

Tel: +81-45-415-5858

<http://jp.fujitsu.com/fsl/en/>

*For further information please contact:*

### North and South America

FUJITSU SEMICONDUCTOR 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://us.fujitsu.com/micro/>

### Europe

FUJITSU SEMICONDUCTOR EUROPE GmbH

Pittlerstrasse 47, 63225 Langen, Germany

Tel: +49-6103-690-0 Fax: +49-6103-690-122

<http://emea.fujitsu.com/semiconductor/>

### Korea

FUJITSU SEMICONDUCTOR KOREA LTD.

902 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/fsk/>

### Asia Pacific

FUJITSU SEMICONDUCTOR ASIA PTE. LTD.

151 Lorong Chuan,

#05-08 New Tech Park 556741 Singapore

Tel : +65-6281-0770 Fax : +65-6281-0220

<http://sg.fujitsu.com/semiconductor/>

FUJITSU SEMICONDUCTOR 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/fss/>

FUJITSU SEMICONDUCTOR 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/fsp/>

Specifications are subject to change without notice. For further information please contact each office.

### All Rights Reserved.

The contents of this document are subject to change without notice.

Customers are advised to consult with sales representatives before ordering.

The information, such as descriptions of function and application circuit examples, in this document are presented solely for the purpose of reference to show examples of operations and uses of FUJITSU SEMICONDUCTOR device; FUJITSU SEMICONDUCTOR does not warrant proper operation of the device with respect to use based on such information. When you develop equipment incorporating the device based on such information, you must assume any responsibility arising out of such use of the information.

FUJITSU SEMICONDUCTOR assumes no liability for any damages whatsoever arising out of the use of the information.

Any information in this document, including descriptions of function and schematic diagrams, shall not be construed as license of the use or exercise of any intellectual property right, such as patent right or copyright, or any other right of FUJITSU SEMICONDUCTOR or any third party or does FUJITSU SEMICONDUCTOR warrant non-infringement of any third-party's intellectual property right or other right by using such information. FUJITSU SEMICONDUCTOR assumes no liability for any infringement of the intellectual property rights or other rights of third parties which would result from the use of information contained herein.

The products described in this document are designed, developed and manufactured as contemplated for general use, including without limitation, ordinary industrial use, general office use, personal use, and household use, but are not designed, developed and manufactured as contemplated (1) for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could have a serious effect to the public, and could lead directly to death, personal injury, severe physical damage or other loss (i.e., nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system), or (2) for use requiring extremely high reliability (i.e., submersible repeater and artificial satellite).

Please note that FUJITSU SEMICONDUCTOR will not be liable against you and/or any third party for any claims or damages arising in connection with above-mentioned uses of the products.

Any semiconductor devices have an inherent chance of failure. You must protect against injury, damage or loss from such failures by incorporating safety design measures into your facility and equipment such as redundancy, fire protection, and prevention of over-current levels and other abnormal operating conditions.

Exportation/release of any products described in this document may require necessary procedures in accordance with the regulations of the Foreign Exchange and Foreign Trade Control Law of Japan and/or US export control laws.

The company names and brand names herein are the trademarks or registered trademarks of their respective owners.

Edited: Sales Promotion Department