

# 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.

Unlike SRAM, MB85R256H is able to retain data without back-up battery.

The memory cells used for the MB85R256H has improved at least  $10^{10}$  times of read/write access per bit, significantly outperforming FLASH memory and E<sup>2</sup>PROM in durability.

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

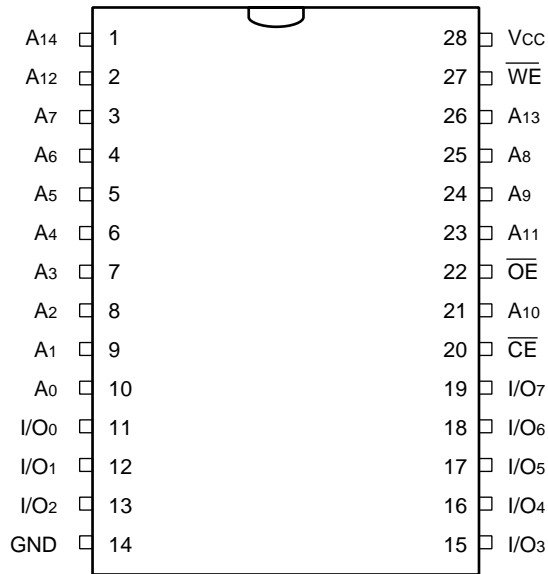
### ■ FEATURES

- Bit configuration: 32,768 words x 8 bits
- Read/write durability:  $10^{10}$  times/bit (Min)
- Peripheral circuit CMOS construction
- Operating power supply voltage: 2.7 V to 3.6 V
- Operating temperature range: -40 °C to +85 °C
- 28-pin, SOP flat package
- 28-pin, TSOP(1) flat package

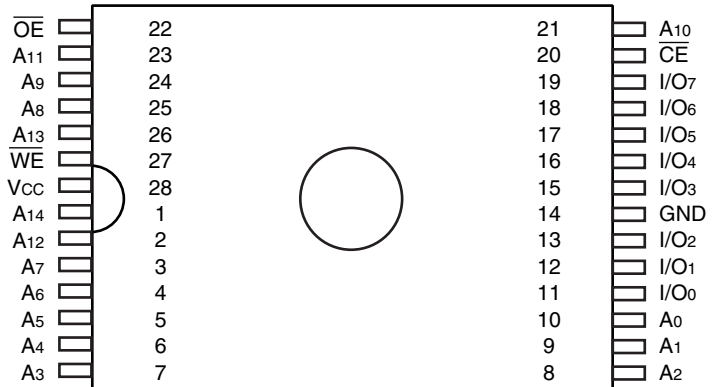
# MB85R256H

## ■ PIN ASSIGNMENTS

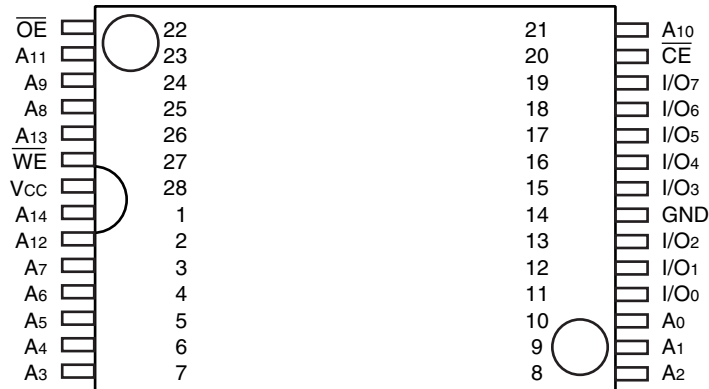
(TOP VIEW)



(FPT-28P-M17)



(FPT-28P-M03)



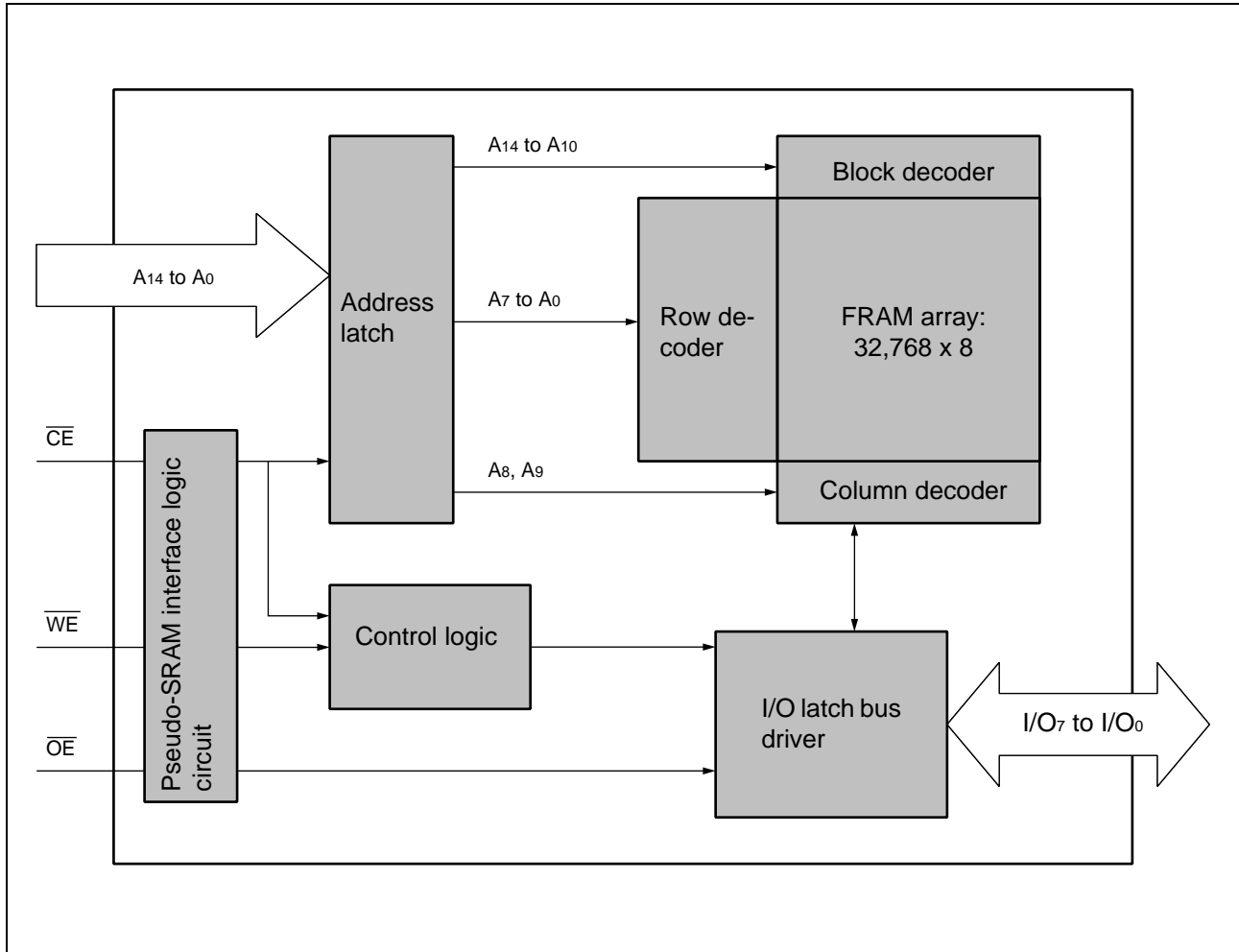
(FPT-28P-M19)

## ■ PIN DESCRIPTIONS

Pin No.	Pin name	Function
10 to 1	$A_0$ 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

# MB85R256H

## ■ BLOCK DIAGRAM



## ■ FUNCTION LIST

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

H: High level, L: Low level, x: 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

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	$V_{IH}$	$0.8 \times V_{CC}$	—	$V_{CC} + 0.5$	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 FUJITSU representatives beforehand.

# MB85R256H

## ■ 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 = $V_{CC} - 0.2\text{ V}/0.2\text{ V}$ , $t_{RC}(\text{Min})$ , $I_{i/o} = 0\text{ mA}$	—	5	10	mA
Standby current	$I_{SB}$	$\overline{CE}, \overline{WE}, \overline{OE} \geq V_{CC}$	—	5	100	$\mu\text{A}$
High level output voltage	$V_{OH}$	$I_{OH} = -100\ \mu\text{A}$	$0.8 \times V_{CC}$	—	—	V
Low level output voltage	$V_{OL}$	$I_{OL} = 1.0\text{ mA}$	—	—	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	2,000	
Read pulse width	$t_{RP}$	70	2,000	
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	2,000	
Write pulse width	$t_{WP}$	70	2,000	
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) Power ON/OFF sequence

(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 interval	$t_{pi}$	1	—	—	s

## 3. Pin Capacitance

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

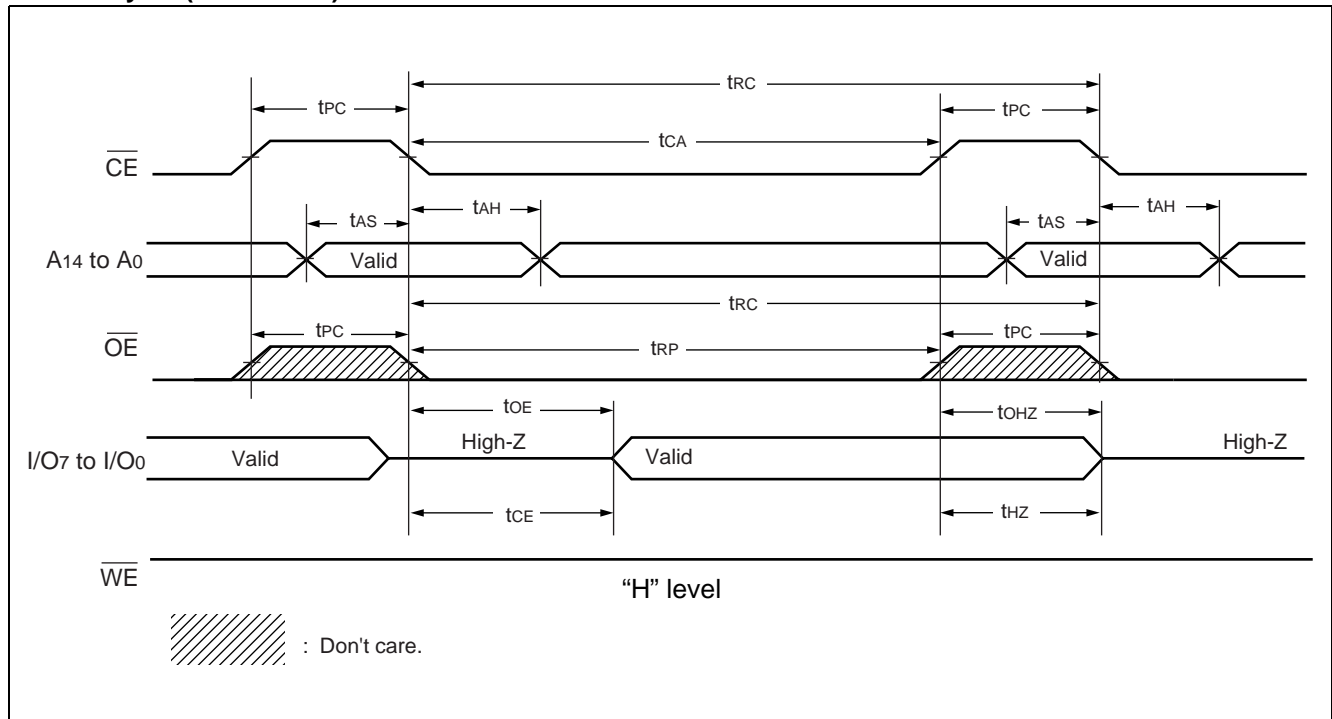
Output evaluation level : 2.0 V/0.8 V

Output load : 100 pF

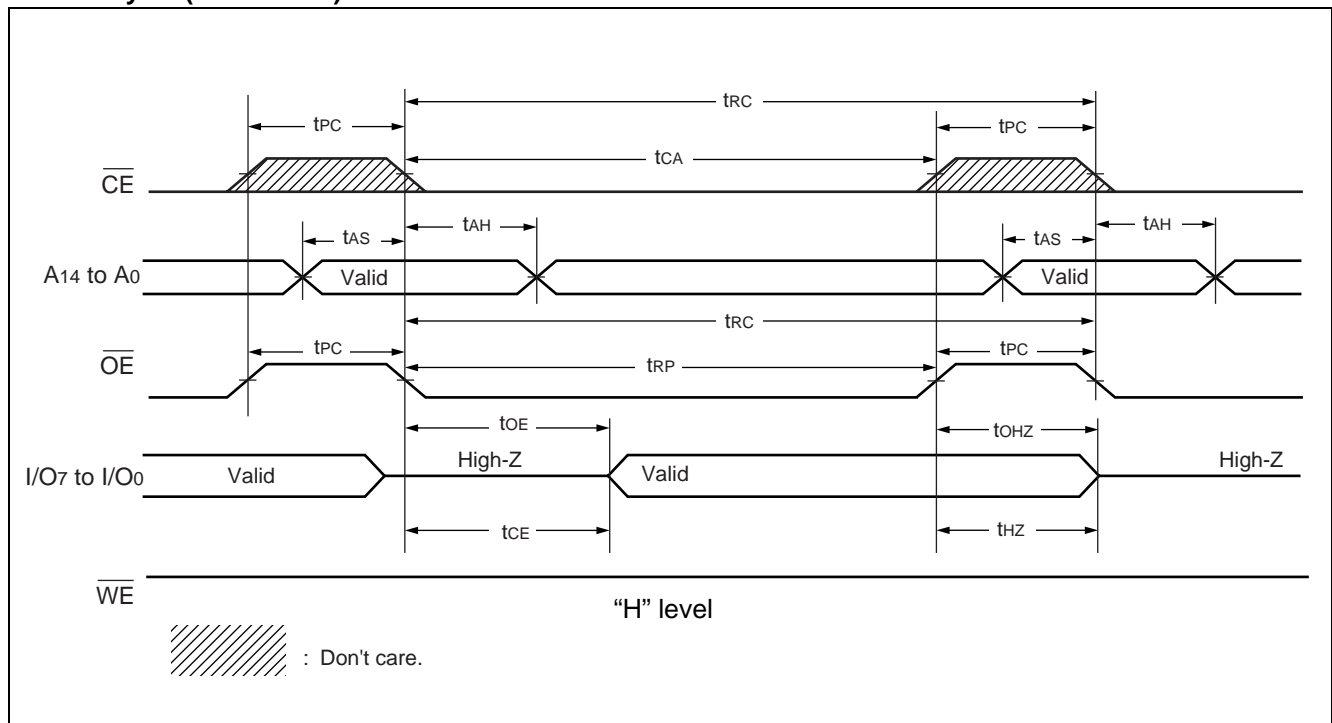
# MB85R256H

## ■ TIMING DIAGRAM

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

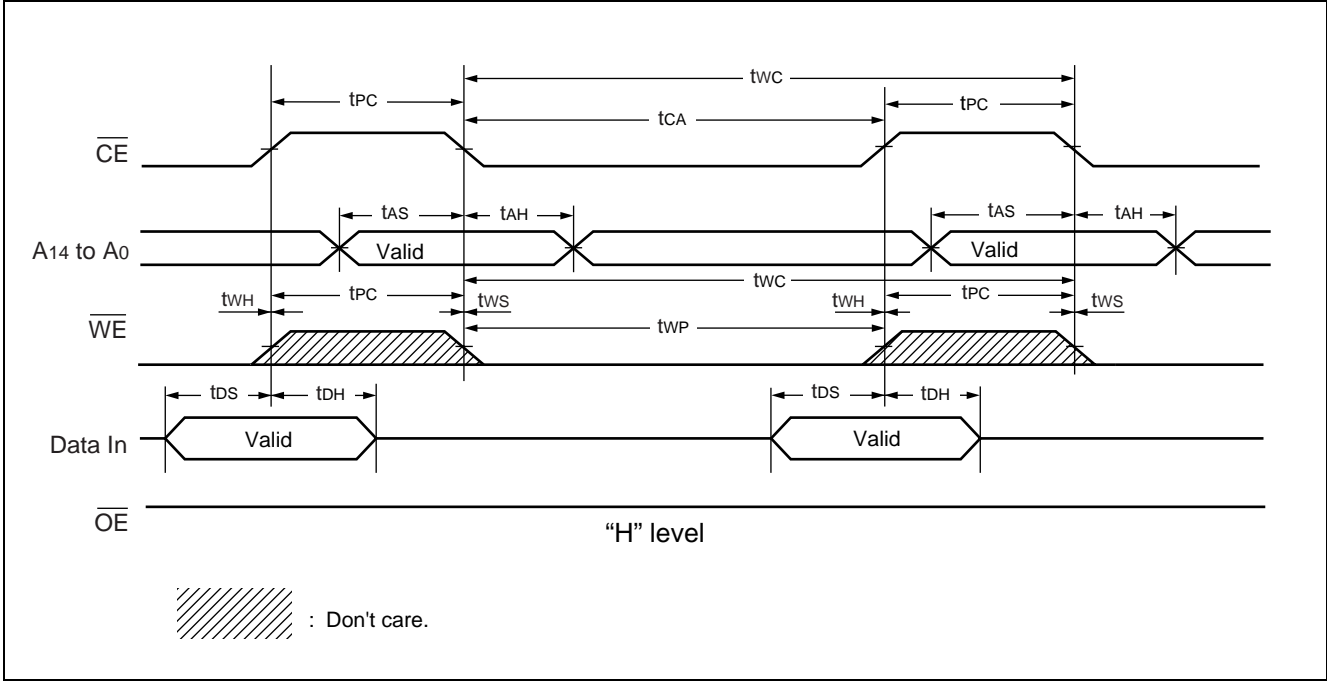


### 2. Read cycle ( $\overline{OE}$ Control)

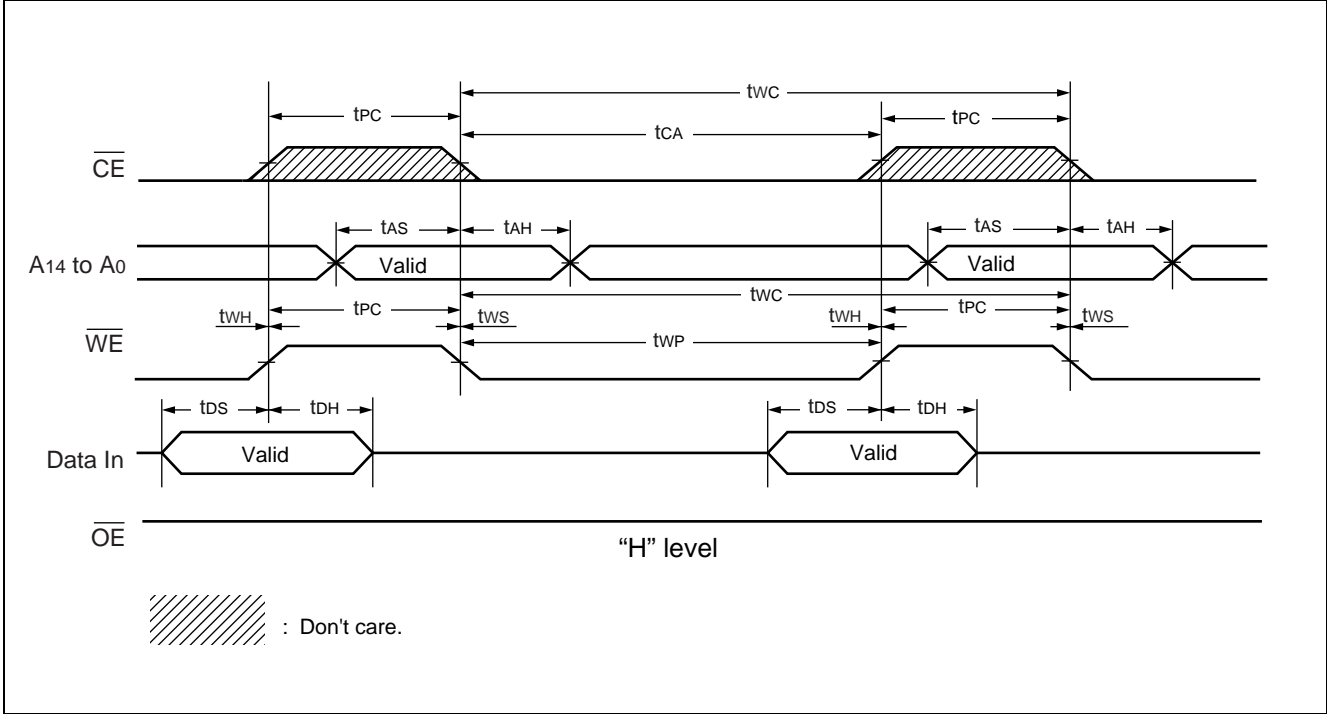




3. Write cycle ( $\overline{\text{CE}}$  Control)

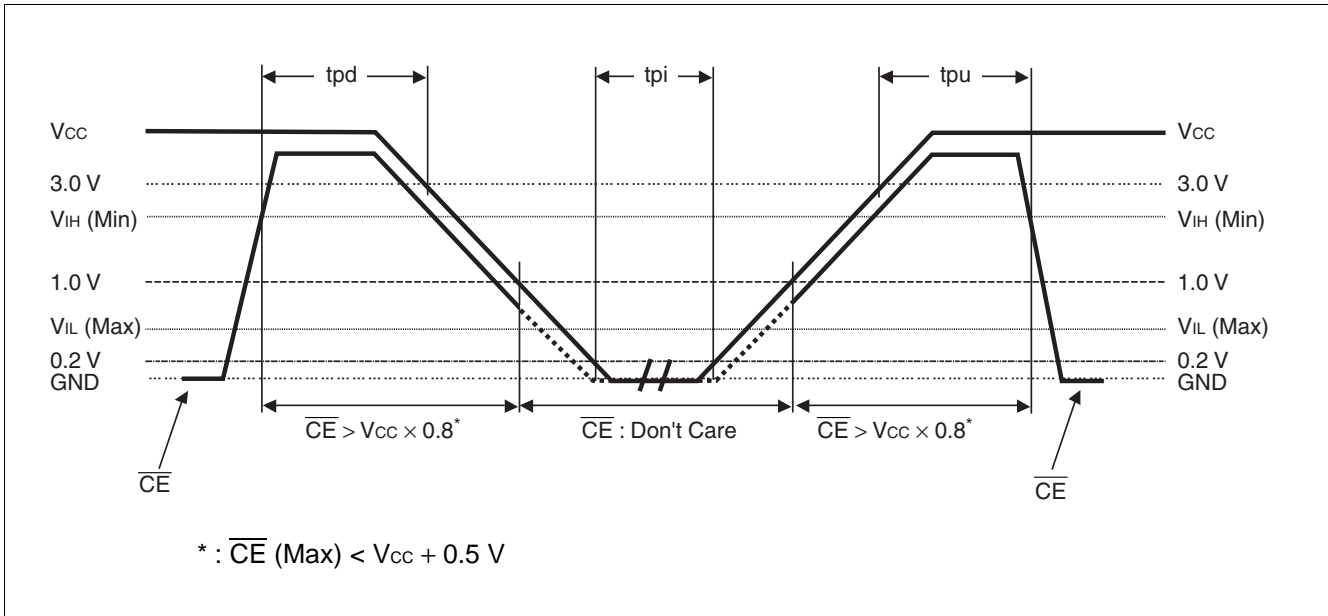


4. Write cycle ( $\overline{\text{WE}}$  Control)



# MB85R256H

## POWER ON/OFF SEQUENCE



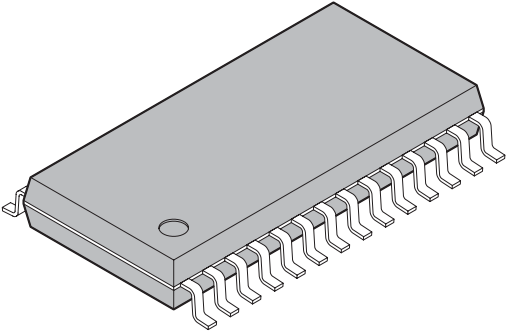
## NOTES ON USE

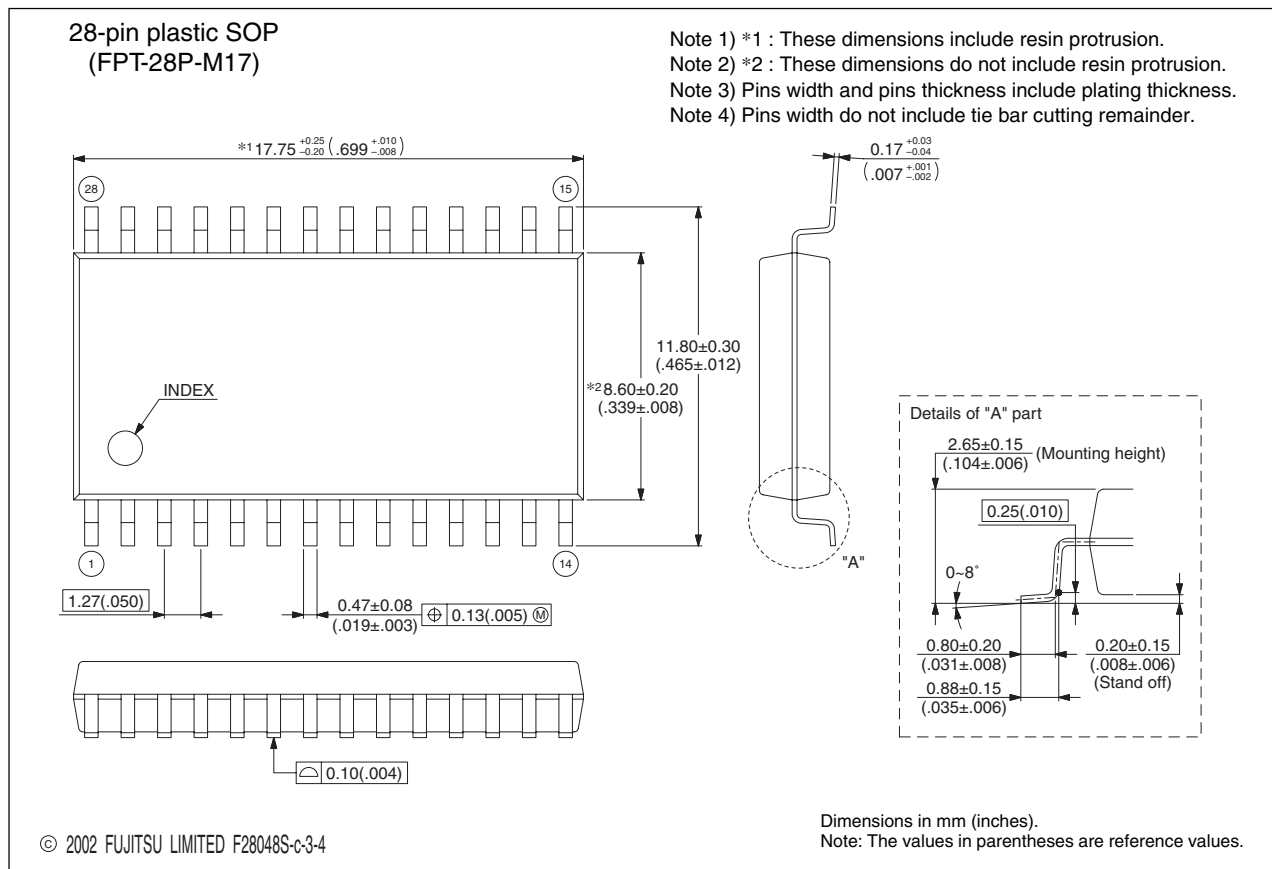
After IR reflow, the hold of data that was written before IR reflow is not guaranteed.

## ORDERING INFORMATION

Part number	Package	Remarks
MB85R256HPF	28-pin, plastic SOP (FPT-28P-M17)	
MB85R256HPFTN	28-pin, plastic TSOP(1) (FPT-28P-M03)	
MB85R256HPFCN	28-pin, plastic TSOP(1) (FPT-28P-M19)	Cu Lead Frame

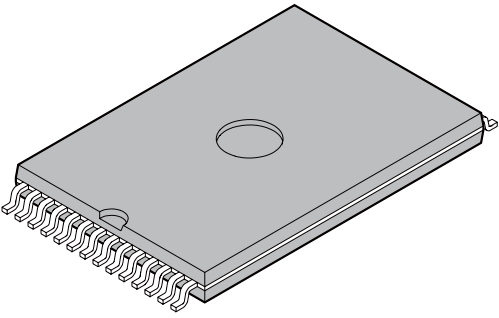
## ■ PACKAGE DIMENSIONS

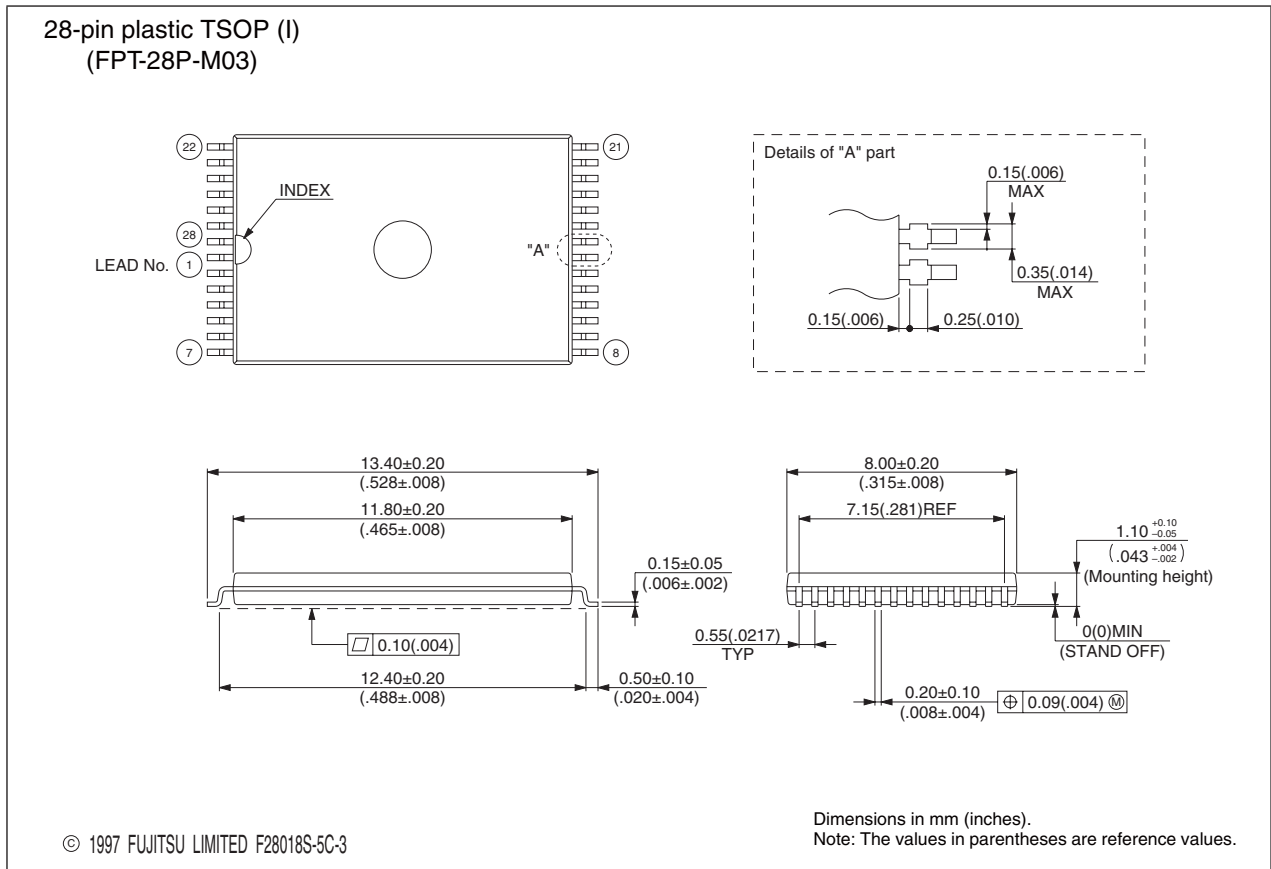
 <p>28-pin plastic SOP</p> <p>(FPT-28P-M17)</p>	Lead pitch	1.27 mm
	Package width × package length	8.6 × 17.75 mm
	Lead shape	Gullwing
	Sealing method	Plastic mold
	Mounting height	2.80 mm MAX
	Weight	0.82 g
	Code (Reference)	P-SOP28-8.6×17.75-1.27



(Continued)

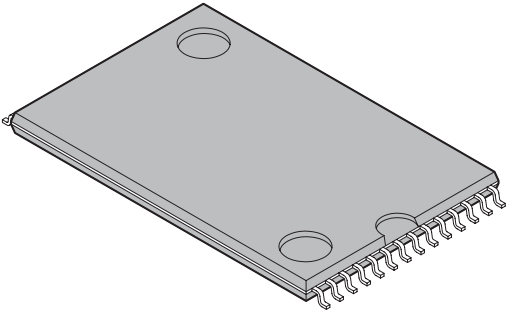
# MB85R256H

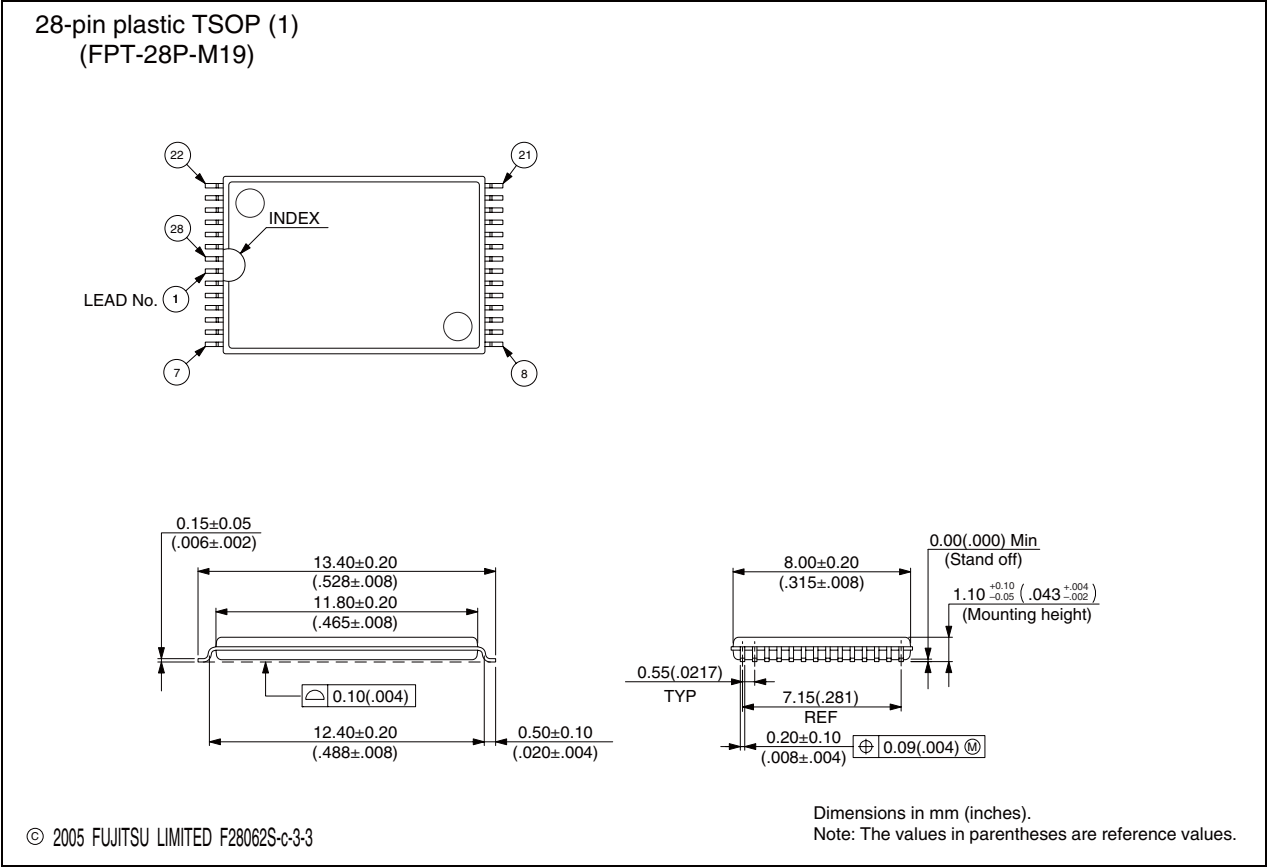
<p>28-pin plastic TSOP (I)</p>  <p>(FPT-28P-M03)</p>	Lead pitch	0.55 mm	
	Lead shape	Gullwing	
	Sealing method	Plastic mold	
	Lead bend direction	Normal bend	



(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



## FUJITSU LIMITED

All Rights Reserved.

The contents of this document are subject to change without notice. Customers are advised to consult with FUJITSU 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 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 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 or any third party or does Fujitsu warrant non-infringement of any third-party's intellectual property right or other right by using such information. Fujitsu 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 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.

If any products described in this document represent goods or technologies subject to certain restrictions on export under the Foreign Exchange and Foreign Trade Law of Japan, the prior authorization by Japanese government will be required for export of those products from Japan.

Edited Business Promotion Dept.