

# Memory FRAM

CMOS

## 256 K (32 K × 8) Bit

# MB85R256

### ■ DESCRIPTIONS

The MB85R256 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 MB85R256 is able to retain data without back-up battery.

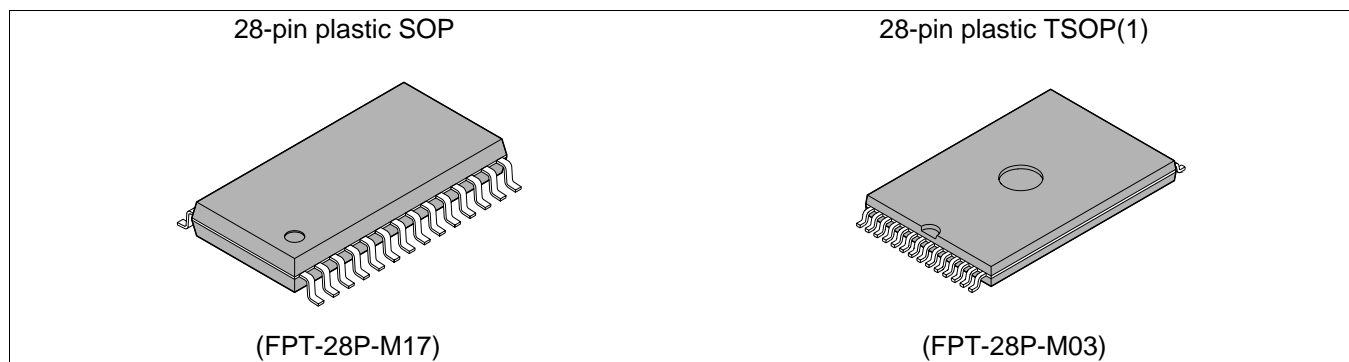
The memory cells used for the MB85R256 has improved at least  $10^{10}$  times of read/write access per bit, significantly outperforming FLASH memory and EEPROM in durability.

The MB85R256 uses a pseudo - SRAM interface compatible with conventional asynchronous SRAM.

### ■ FEATURES

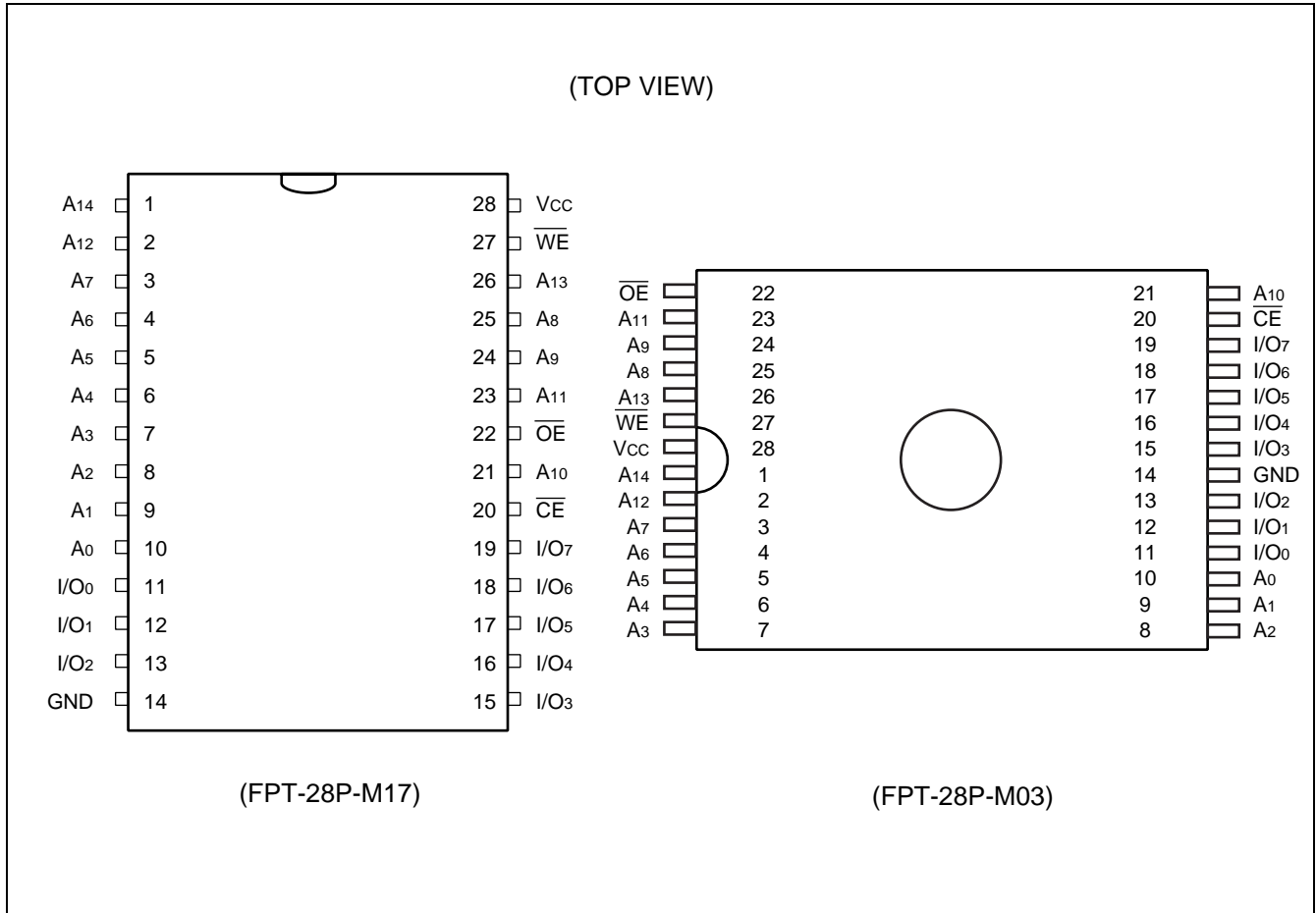
- Bit configuration: 32,768 words x 8 bits
- Read/write durability:  $10^{10}$  times/bit (Min)
- Peripheral circuit CMOS construction
- Operating power supply voltage: 3.0 V to 3.6 V
- Operating temperature range:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- 28-pin, SOP flat package
- 28-pin, TSOP(1) flat package

### ■ PACKAGES



# MB85R256

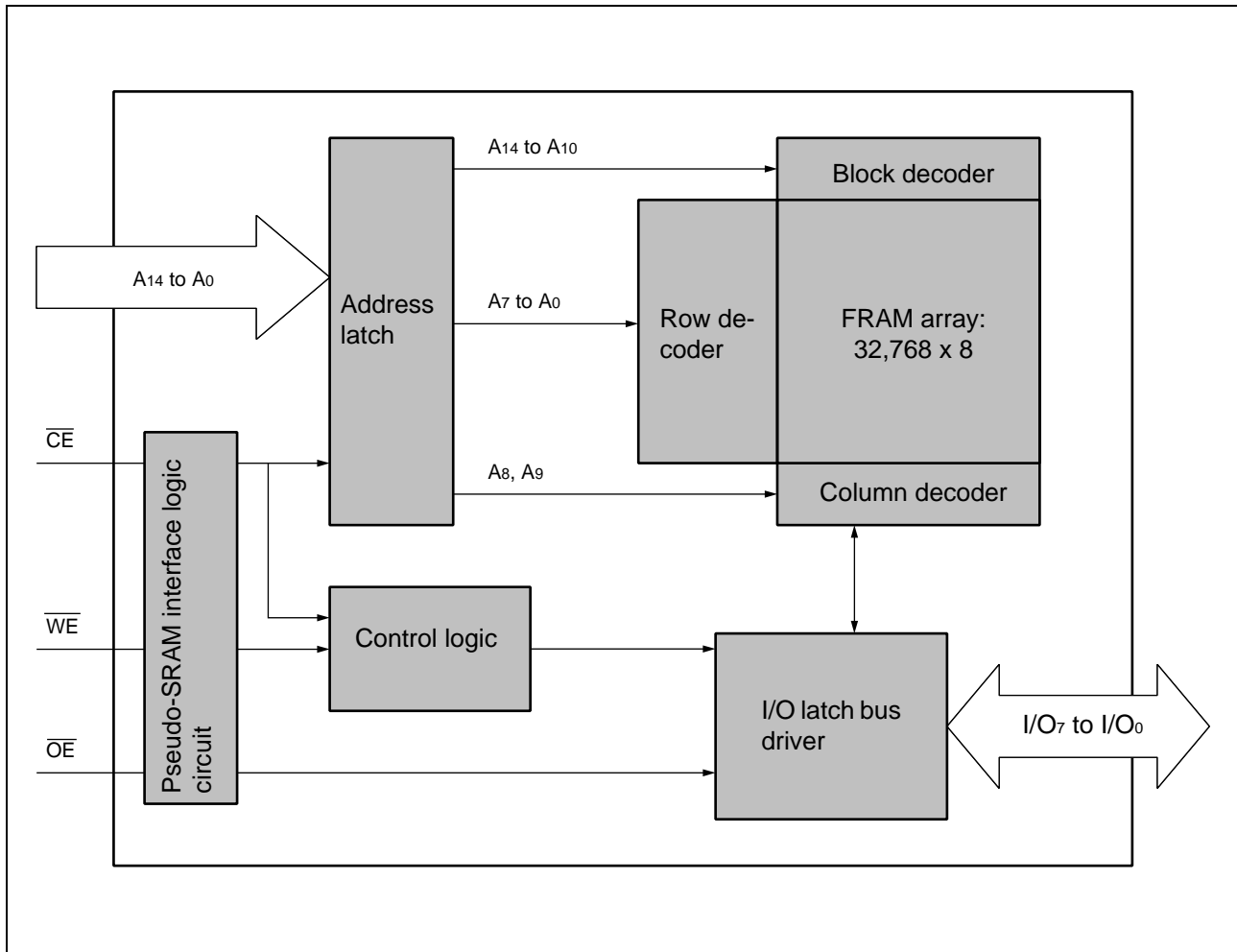
## ■ PIN ASSIGNMENTS



## ■ PIN DESCRIPTIONS

Pin name	Function
A <sub>0</sub> to A <sub>14</sub>	Address Input
I/O <sub>0</sub> to I/O <sub>7</sub>	Data input/output
$\overline{CE}$	Chip enable input
$\overline{WE}$	Write Enable input
$\overline{OE}$	Output enable input
V <sub>cc</sub>	Power supply ( + 3.3 V Typ)
GND	Ground

## ■ 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"

# MB85R256

## ■ ABSOLUTE MAXIMUM RANGES

Parameter	Symbol	Rating		Unit
		Min	Max	
Power supply voltage	$V_{CC}$	- 0.5	+ 4.6	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	+ 85	°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	$V_{CC}$	3.0	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.

## ■ 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	$I_{SB}$	$\overline{CE} \geq V_{CC}$	—	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	$t_{RC}$	235	—	ns
$\overline{CE}$ active time	$t_{CA}$	150	10,000	
Read pulse width	$t_{RP}$	150	10,000	
Precharge time	$t_{PC}$	85	—	
Address setup time	$t_{AS}$	0	—	
Address hold time	$t_{AH}$	25	—	
$\overline{CE}$ access time	$t_{CE}$	—	150	
$\overline{OE}$ access time	$t_{OE}$	—	150	
$\overline{CE}$ output floating time	$t_{HZ}$	—	25	
$\overline{OE}$ output floating time	$t_{OHZ}$	—	25	

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## (2) Write cycle

(within recommended operating conditions)

Parameter	Symbol	Value		Unit
		Min	Max	
Write cycle time	$t_{WC}$	235	—	ns
$\overline{CE}$ active time	$t_{CA}$	150	10,000	
Write pulse width	$t_{WP}$	150	10,000	
Precharge time	$t_{PC}$	85	—	
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	$t_{pd}$	85	—	—	ns
$\overline{CE}$ LEVEL hold time at power ON	$t_{pu}$	85	—	—	ns
Power interval	$t_{pi}$	1	—	—	$\mu s$

## 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 : 3.0 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

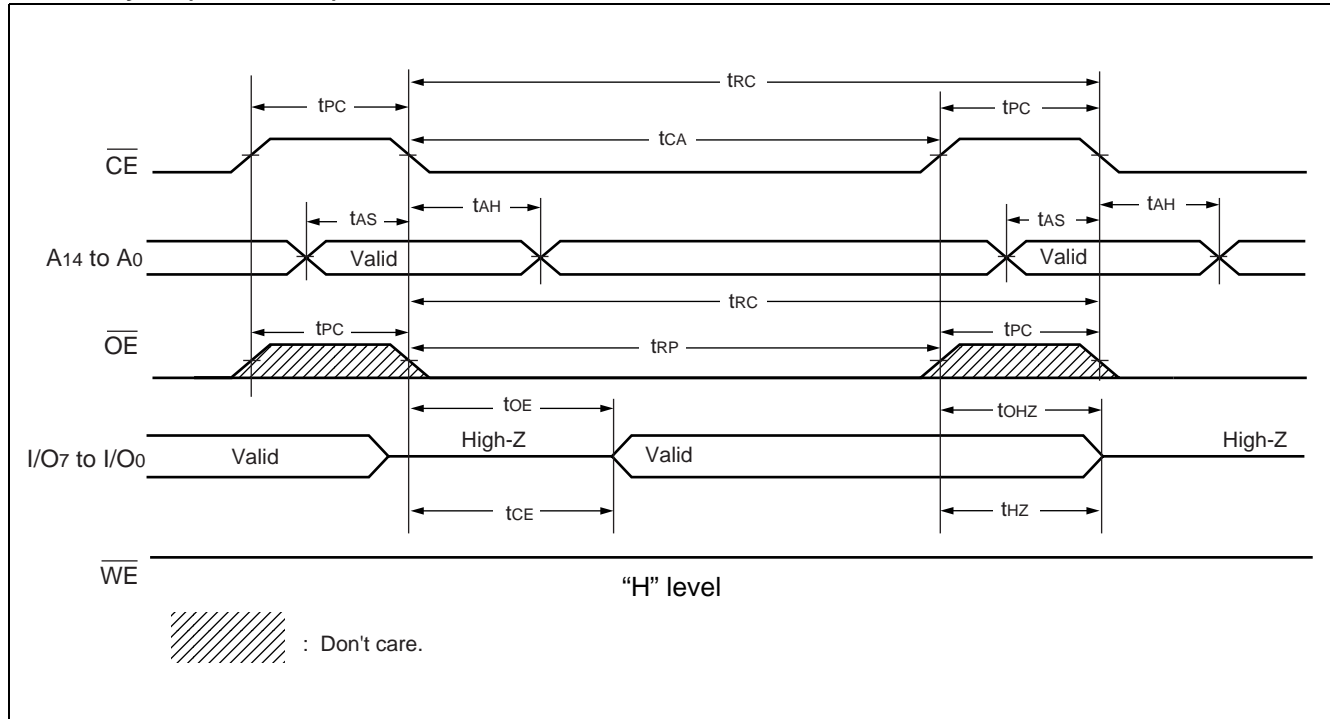
Input evaluation level : 2.0 V/0.8 V

Output evaluation level : 2.0 V/0.8 V

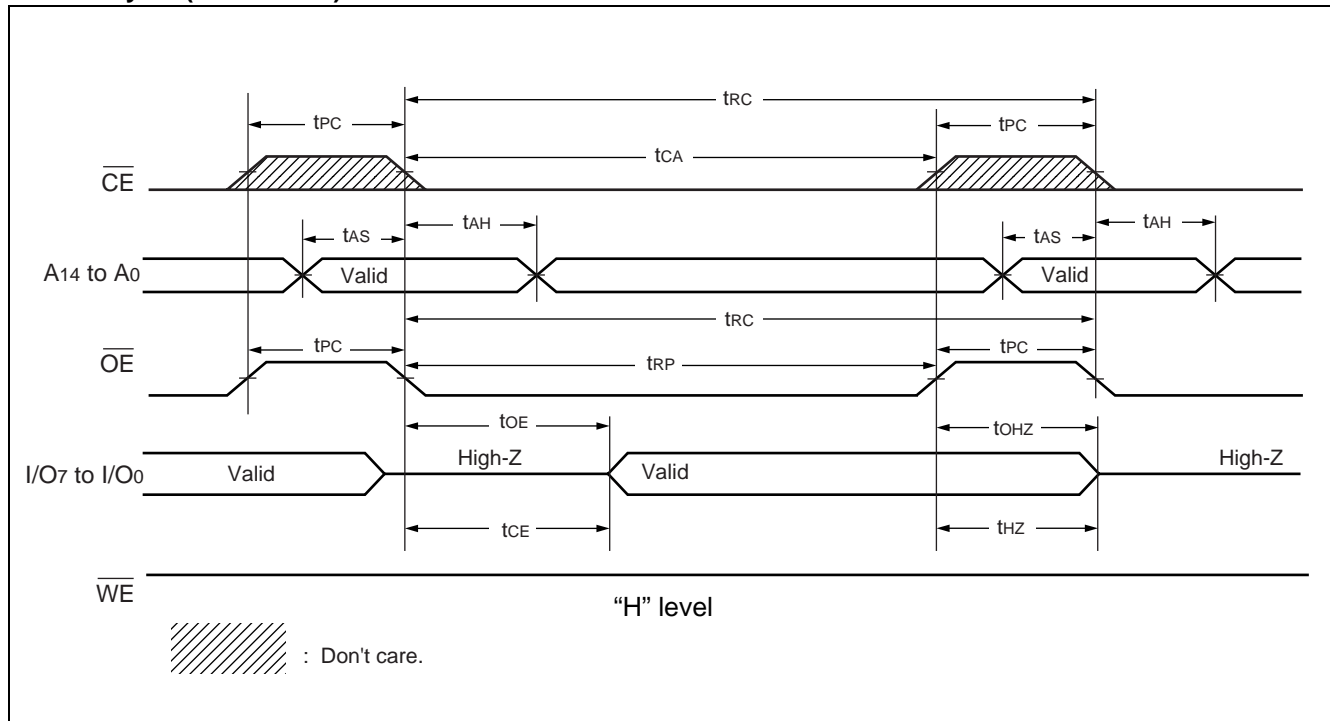
Output load : 100 pF

## TIMING DIAGRAM

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

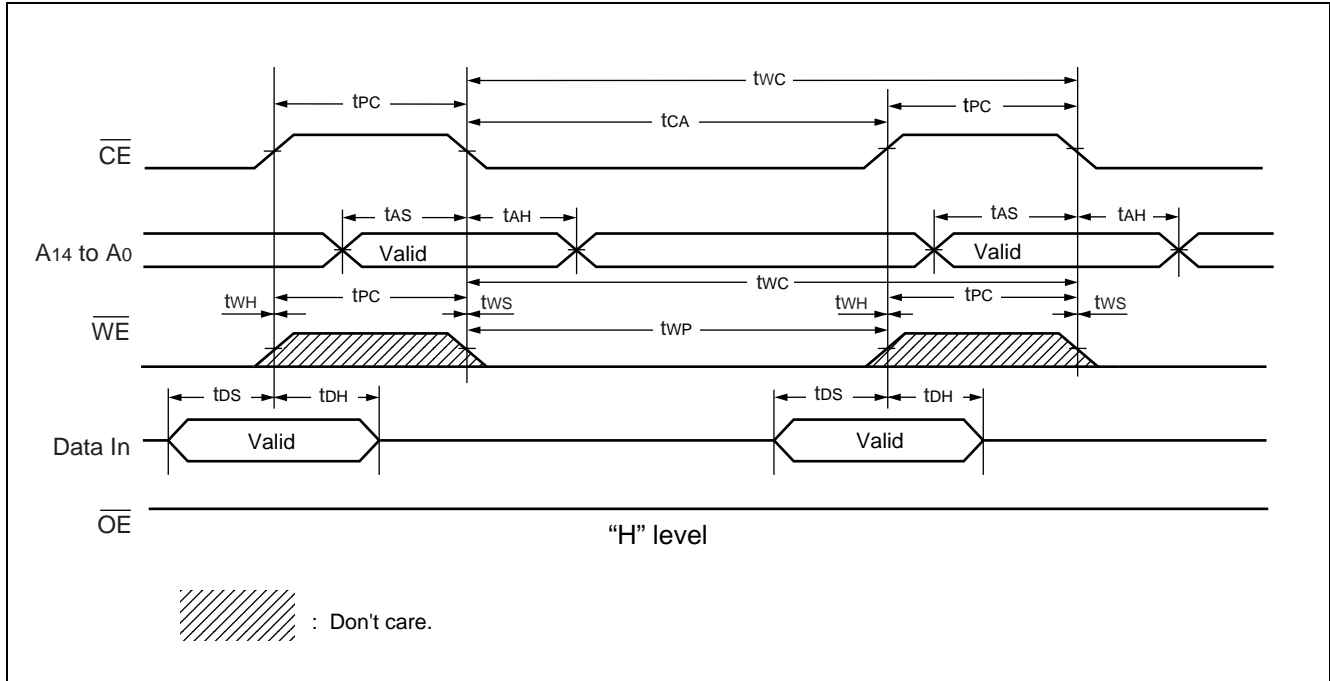


### 2. Read cycle ( $\overline{OE}$ Control)

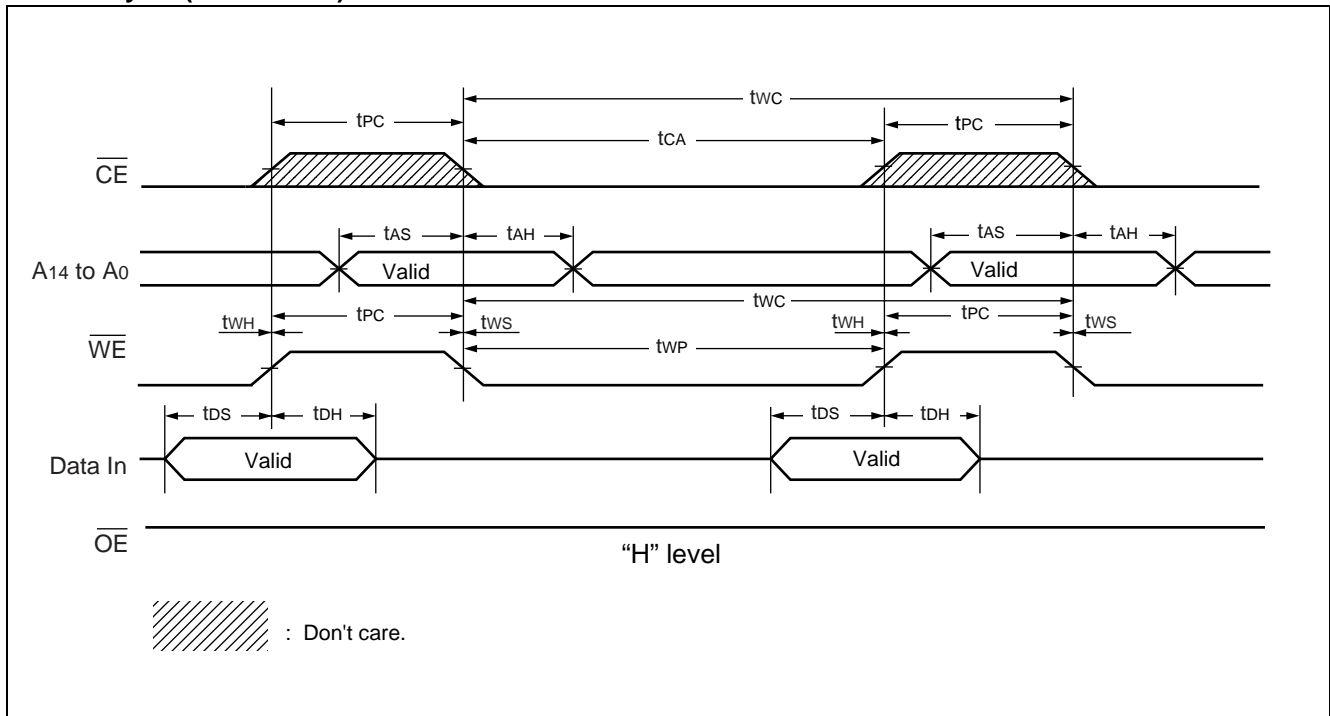


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## 3. Write cycle ( $\overline{\text{CE}}$ Control)

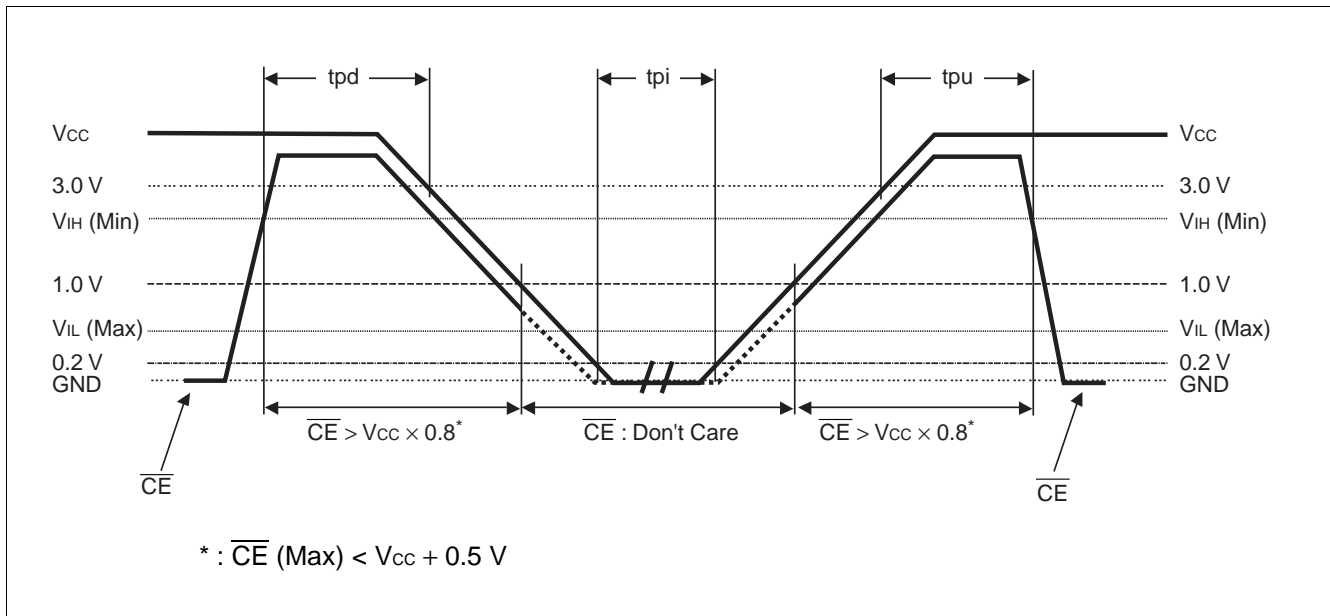


## 4. Write cycle ( $\overline{\text{WE}}$ Control)





## 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

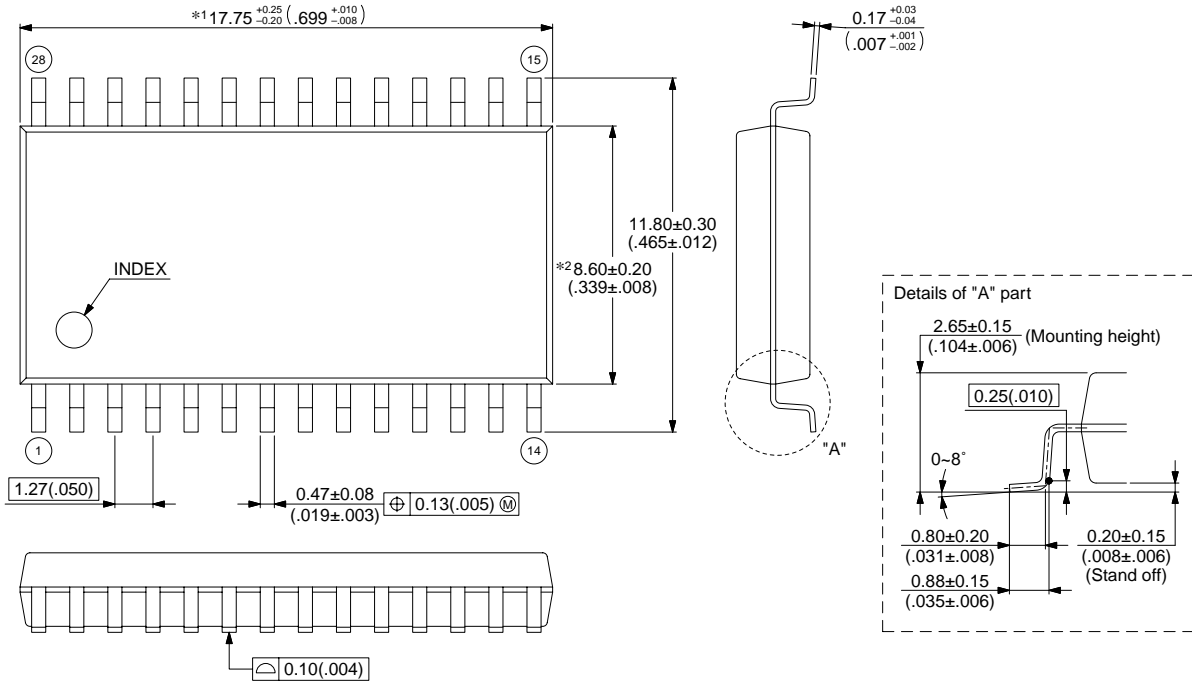
Part number	Package	Remarks
MB85R256PF	28-pin, plastic SOP (FPT-28P-M17)	
MB85R256PFTN	28-pin, plastic TSOP(1) (FPT-28P-M03)	

# MB85R256

## PACKAGE DIMENSIONS

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.



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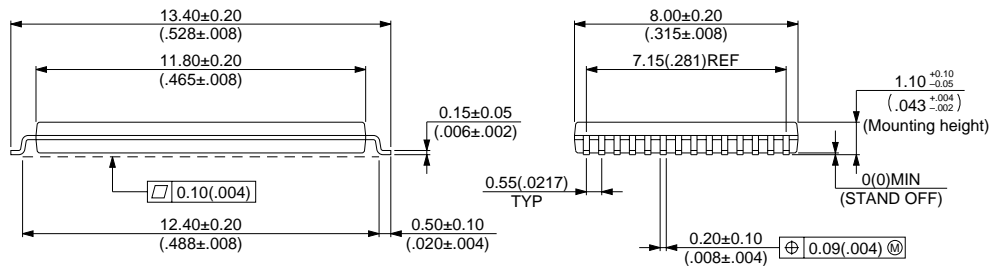
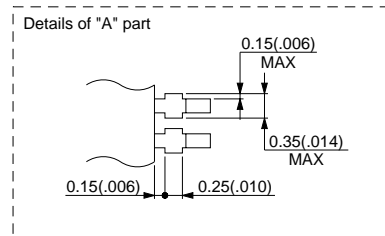
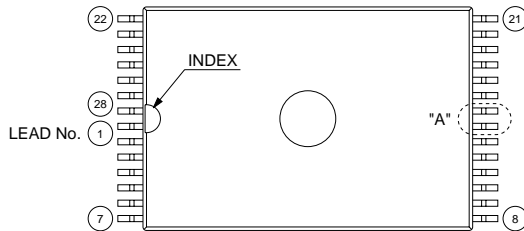
Dimensions in mm (inches).

Note: The values in parentheses are reference values.

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## 28-pin plastic TSOP(1) (FPT-28P-M03)



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Dimensions in mm (inches).

Note: The values in parentheses are reference values.

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