FUJITSU SEMICONDUCTOR
DATA SHEET

DS05-13106-1E

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^2PROM 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

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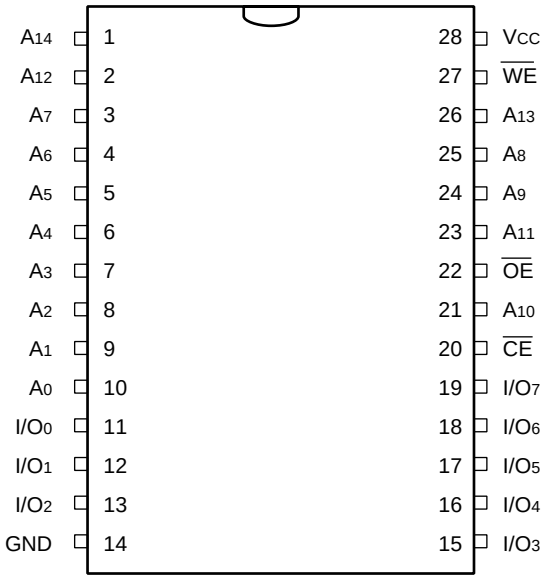
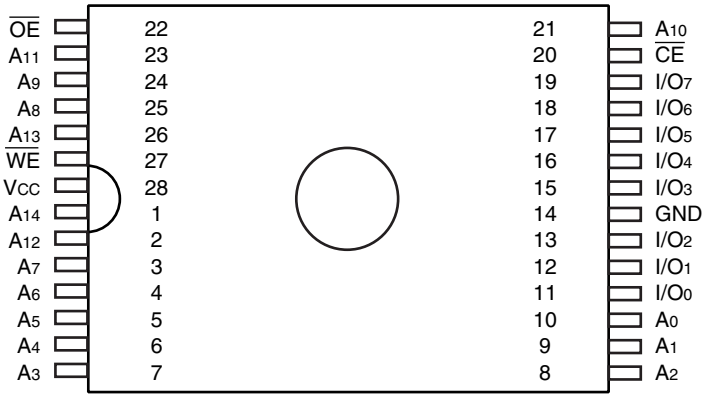
■ PIN ASSIGNMENTS

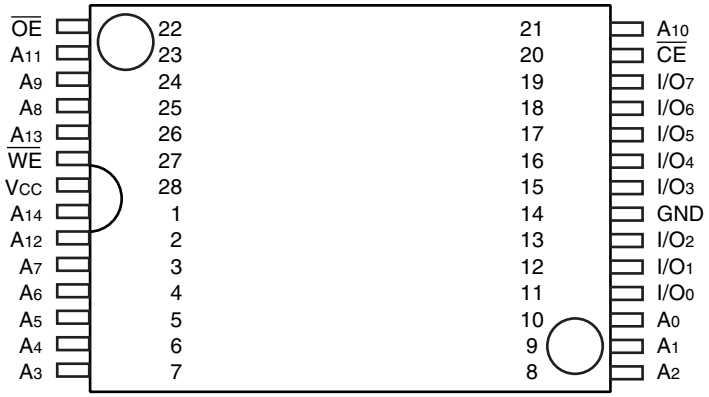
(TOP VIEW)



(FPT-28P-M17)



(FPT-28P-M03)

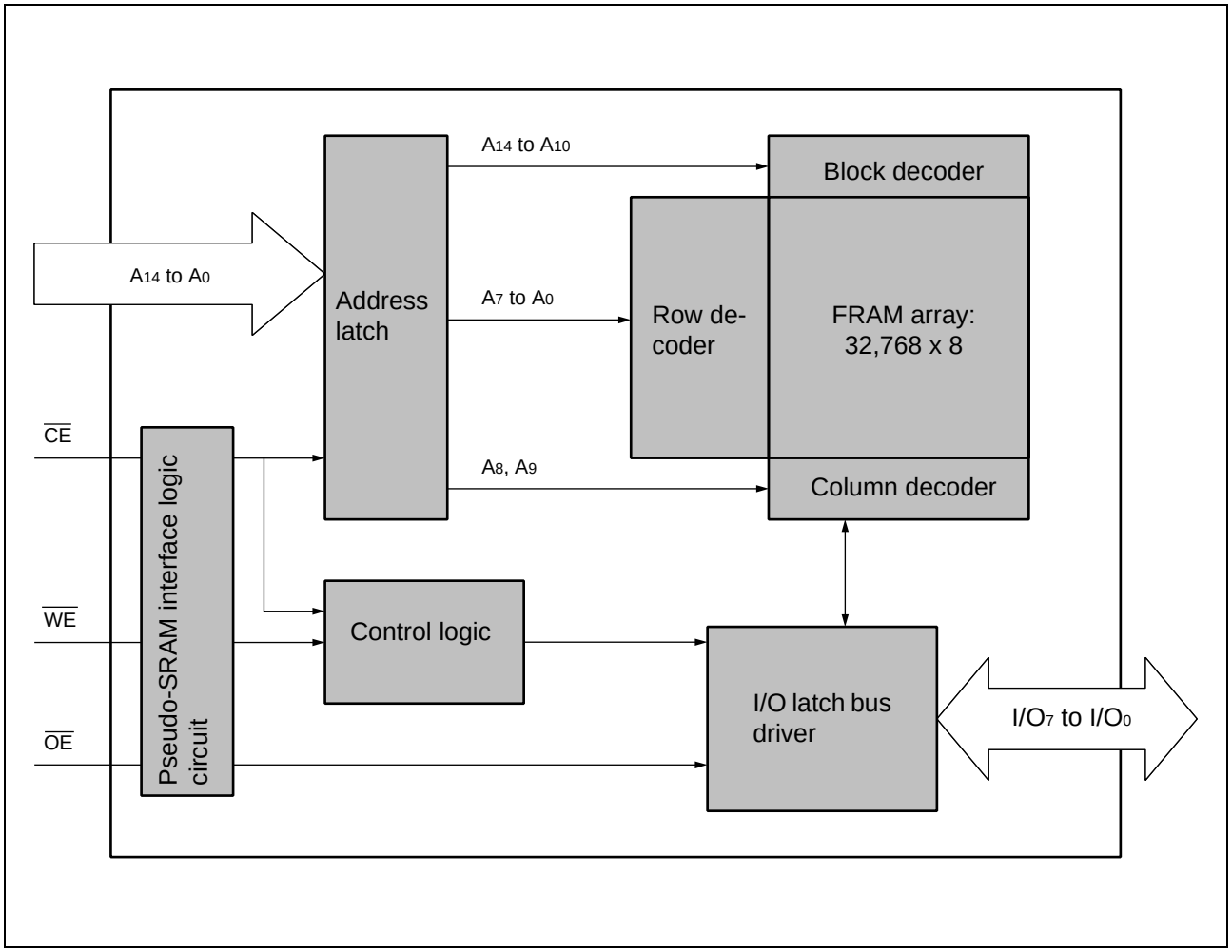


(FPT-28P-M19)

■ 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

■ 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		
Latch address	L	↓	↓	—	—
Write	L	L	H	Data input	Operation (I_{CC})
Read	L	H	L	Data output	
Output Disable	×	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	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}	0.8 × 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	$\lvert I_{LI} \rvert$	V_{IN} = 0 V to V_{CC}	—	—	10	µA
Output leakage current	$\lvert I_{LO} \rvert$	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	100	µA
High level output voltage	V_{OH}	I_{OH} = – 100 µA	0.8 × V_{CC}	—	—	V
Low level output voltage	V_{OL}	I_{OL} = 1.0 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	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	tpd	80	—	—	ns
$\overline{CE}$ LEVEL hold time at power ON	tpu	80	—	—	ns
Power interval	tpi	1	—	—	s

3. Pin Capacitance

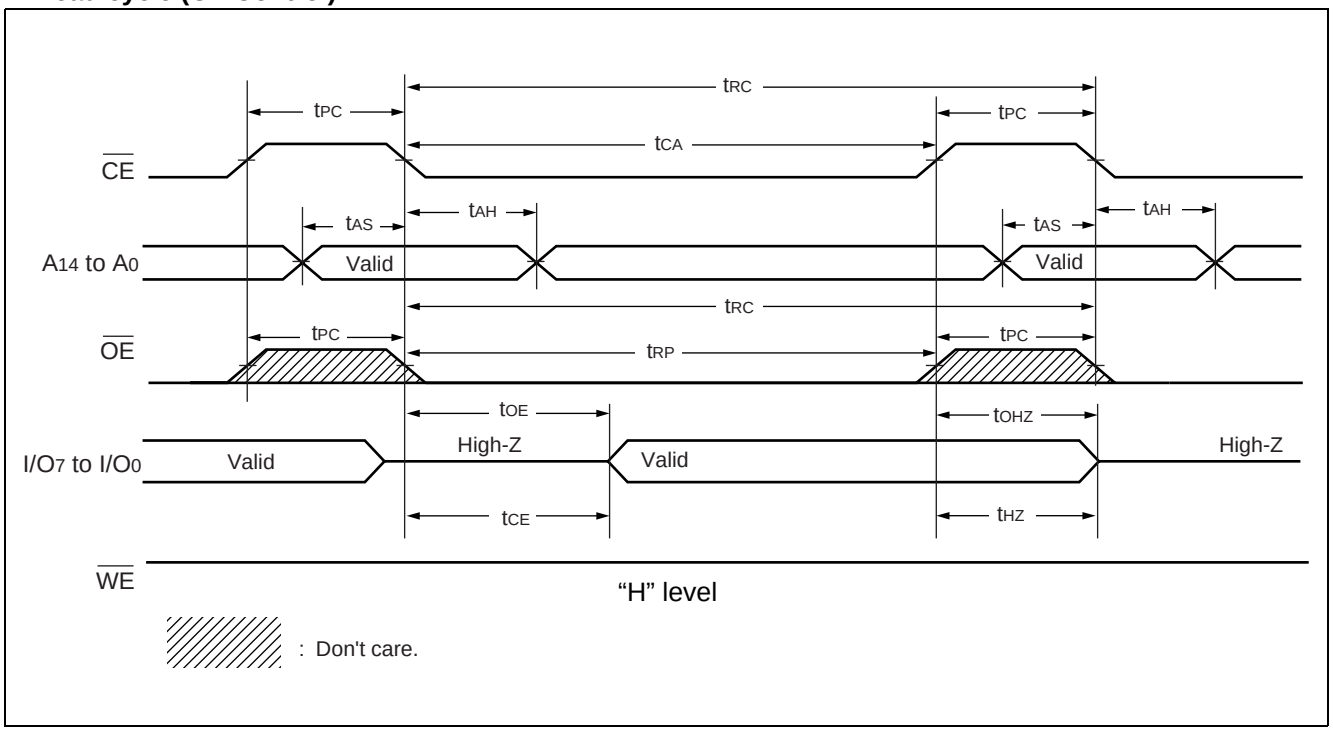
Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Input capacitance	C_{IN}	$V_{IN} = V_{OUT} = GND$, f = 1 MHz, $T_A = +25$ °C	—	—	10	pF
output capacitance	C_{OUT}		—	—	10	pF

4. AC Characteristics Test Condition

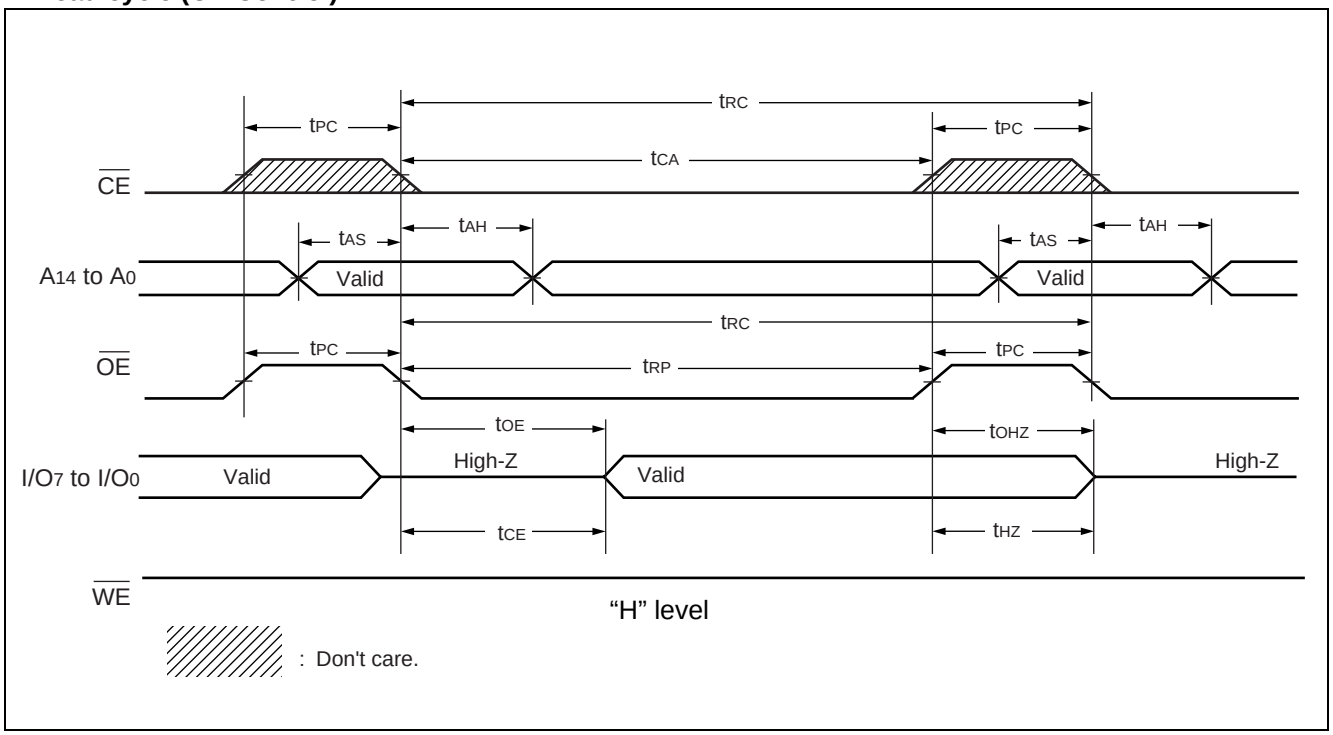
Power supply voltage : 2.7 V to 3.6 V
Input voltage amplitude : 0.3 V to 2.7 V
Input rising time : 10 ns
Input falling time : 10 ns
Input evaluation level : 2.0 V/0.8 V
Output evaluation level : 2.0 V/0.8 V
Output load : 100 pF

■ TIMING DIAGRAM

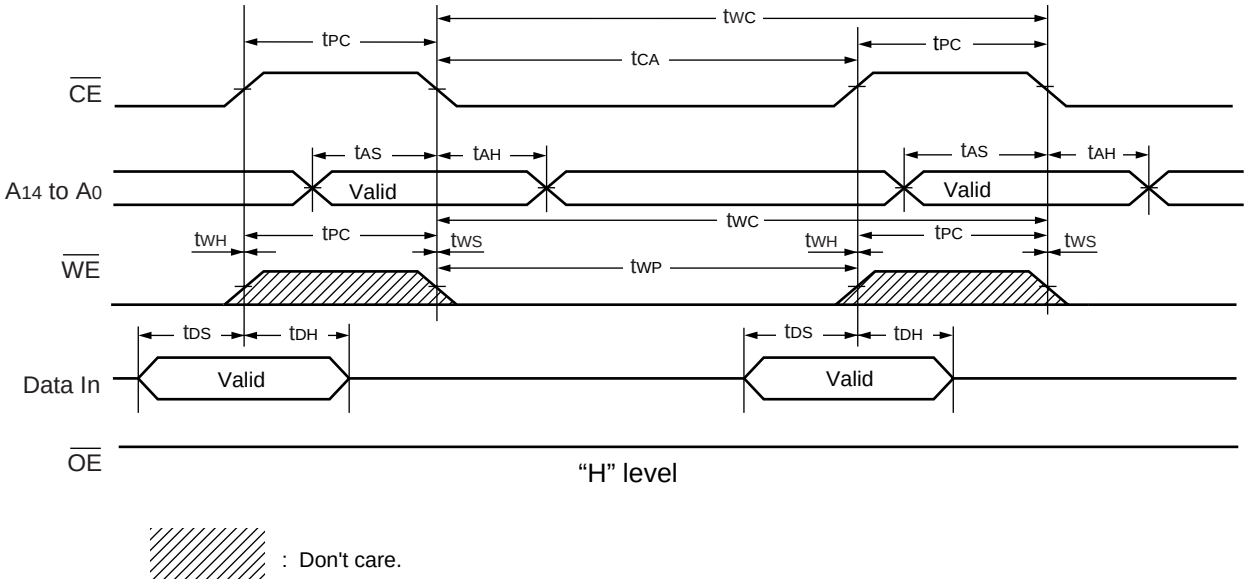
1. Read cycle ($\overline{CE}$ Control)



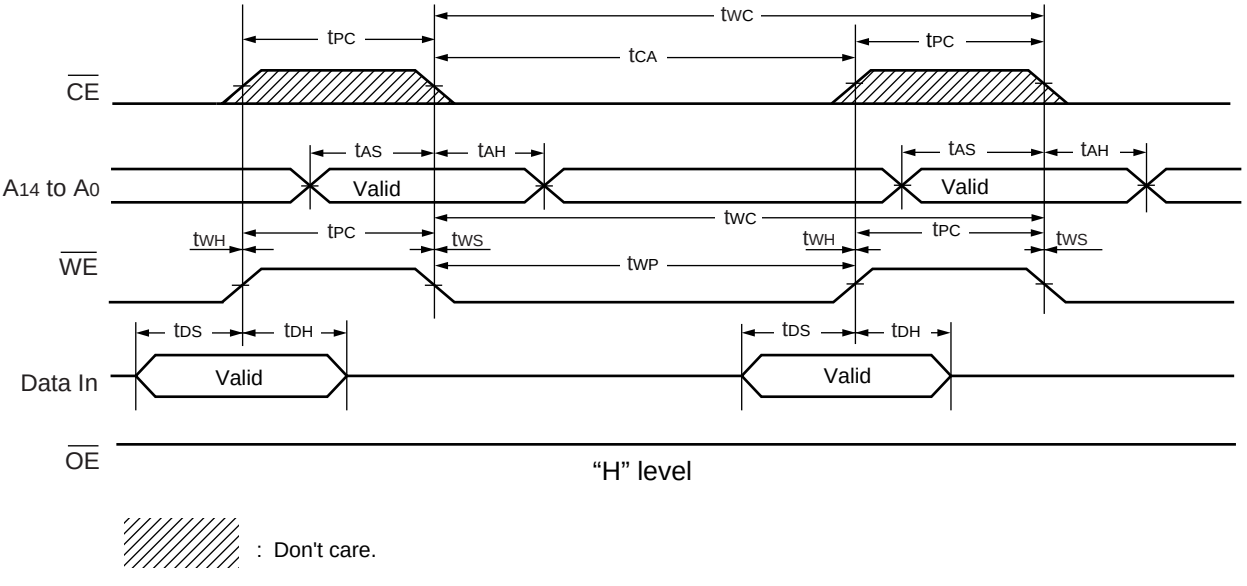
2. Read cycle ($\overline{OE}$ Control)



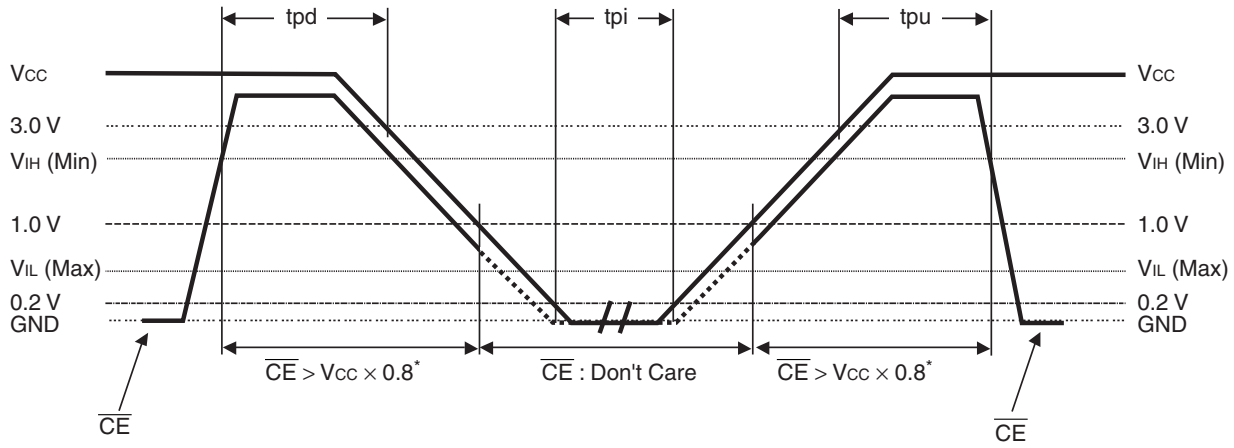
3. Write cycle ($\overline{CE}$ Control)



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



■ POWER ON/OFF SEQUENCE



* : $\overline{CE}$ (Max) < V_{CC} + 0.5 V

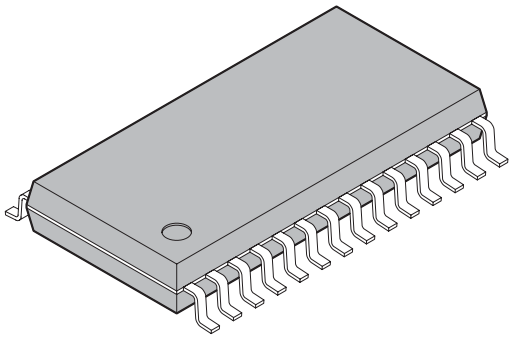
■ NOTES ON USE

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

■ ORDERING INFORMATION

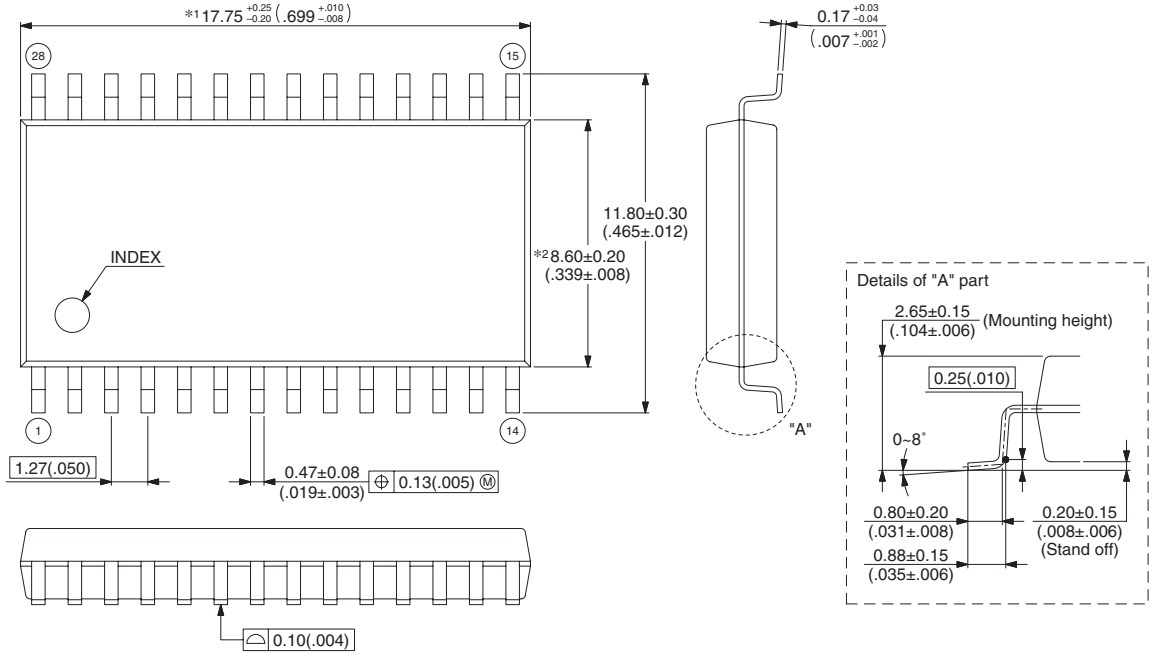
Part number	Package	Remarks
MB85R256HPF	28-pin, plastic SOP (FPT-28P-M17)	
MB85R256HPFTN	28-pin, plastic TSOP(1) (FPT-28P-M03)	
MB85R256HPFCN	28-pin, plastic TSOP(1) (FPT-28P-M19)	Cu Lead Frame

■ PACKAGE DIMENSIONS

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

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.



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

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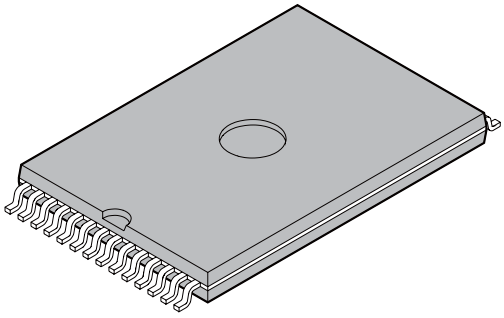
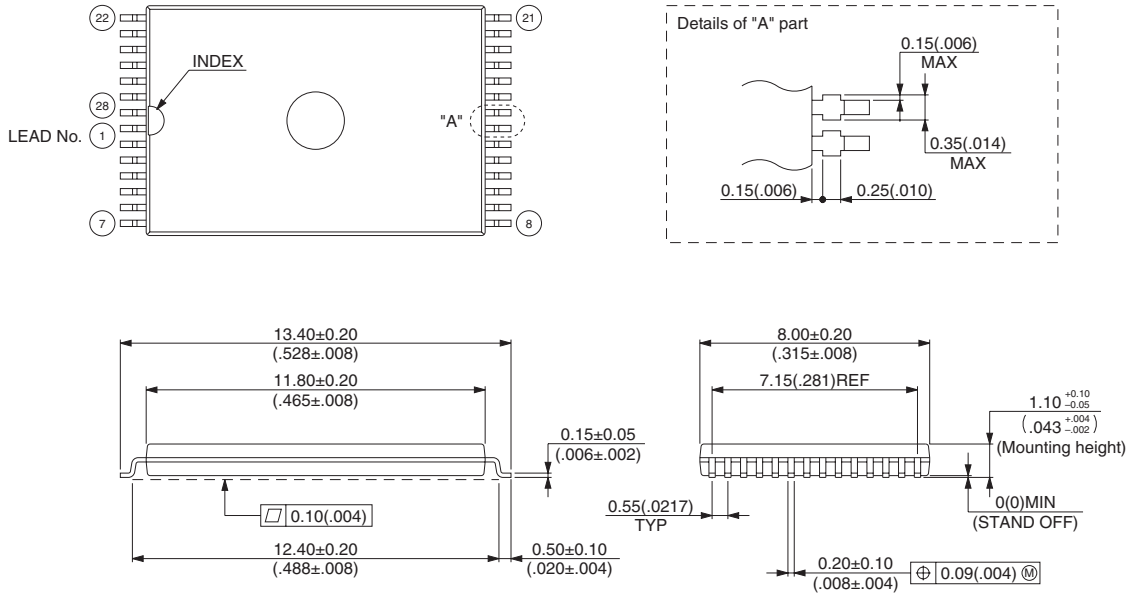
28-pin plastic TSOP (I)		
	Lead pitch	0.55 mm
	Lead shape	Gullwing
	Sealing method	Plastic mold
	Lead bend direction	Normal bend
(FPT-28P-M03)		

28-pin plastic TSOP (I)
(FPT-28P-M03)



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

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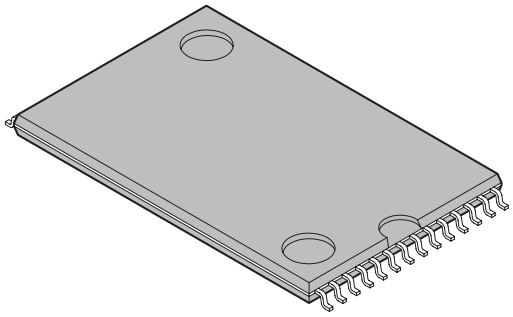
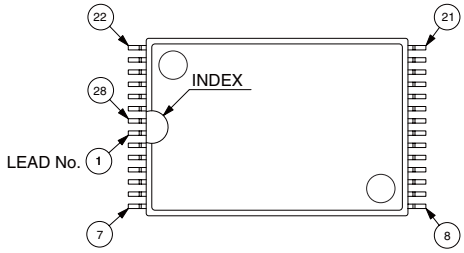
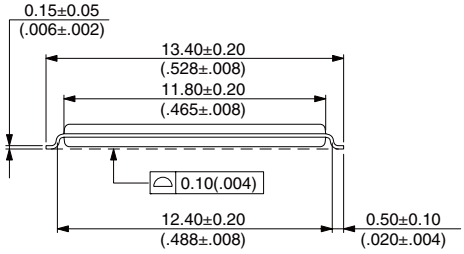
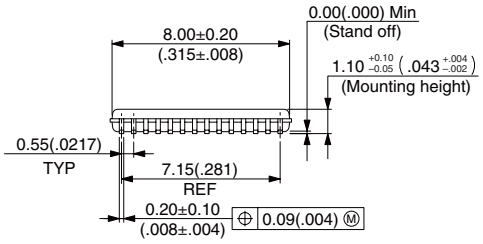
28-pin plastic TSOP (1)		
	Lead pitch	0.55 mm
	Package width × package length	11.80 × 8.00 mm
	Lead shape	Gullwing
	Sealing method	Plastic mold
	Mounting height	1.20 mm Max
	Weight	Approx. 0.25 g
(FPT-28P-M19)	Code (Reference)	P-TSOP(1)28-11.8×8-0.55

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







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

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