FUJITSU MICROELECTRONICS
DATA SHEET

DS05-13103-6Ea

Memory FRAM

CMOS

1 M Bit (128 K × 8)

MB85R1001

■ DESCRIPTIONS

The MB85R1001 is an FRAM (Ferroelectric Random Access Memory) chip consisting of 131,072 words x 8 bits of non-volatile memory cells created using ferroelectric process and silicon gate CMOS process technologies.

The MB85R1001 is able to retain data without using a back-up battery, as is needed for SRAM.

The memory cells used in the MB85R1001 can be used for at least 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 MB85R1001 uses a pseudo-SRAM interface that is compatible with conventional asynchronous SRAM.

■ FEATURES

- Bit configuration : 131,072 words × 8bits
- Read/write endurance : 10^{10} times/bit (Min)
- Operating power supply voltage : 3.0 V to 3.6 V
- Operating temperature range : − 20 °C to + 85 °C
- Data retention : 10 years (+ 55 °C)
- Package : 48-pin plastic TSOP (1)

2008.2

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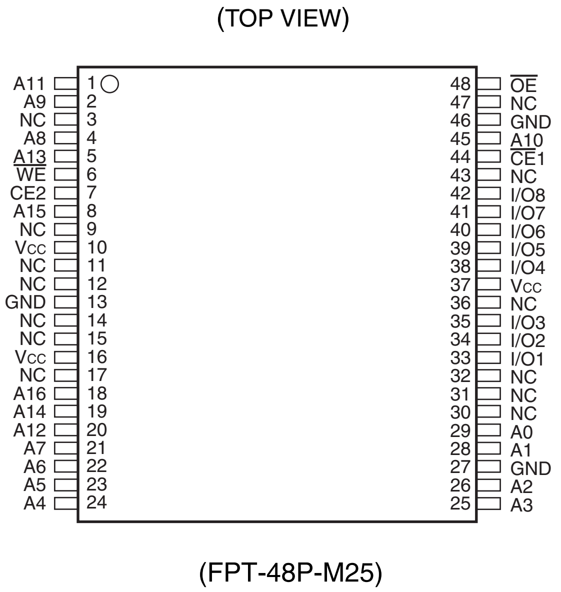
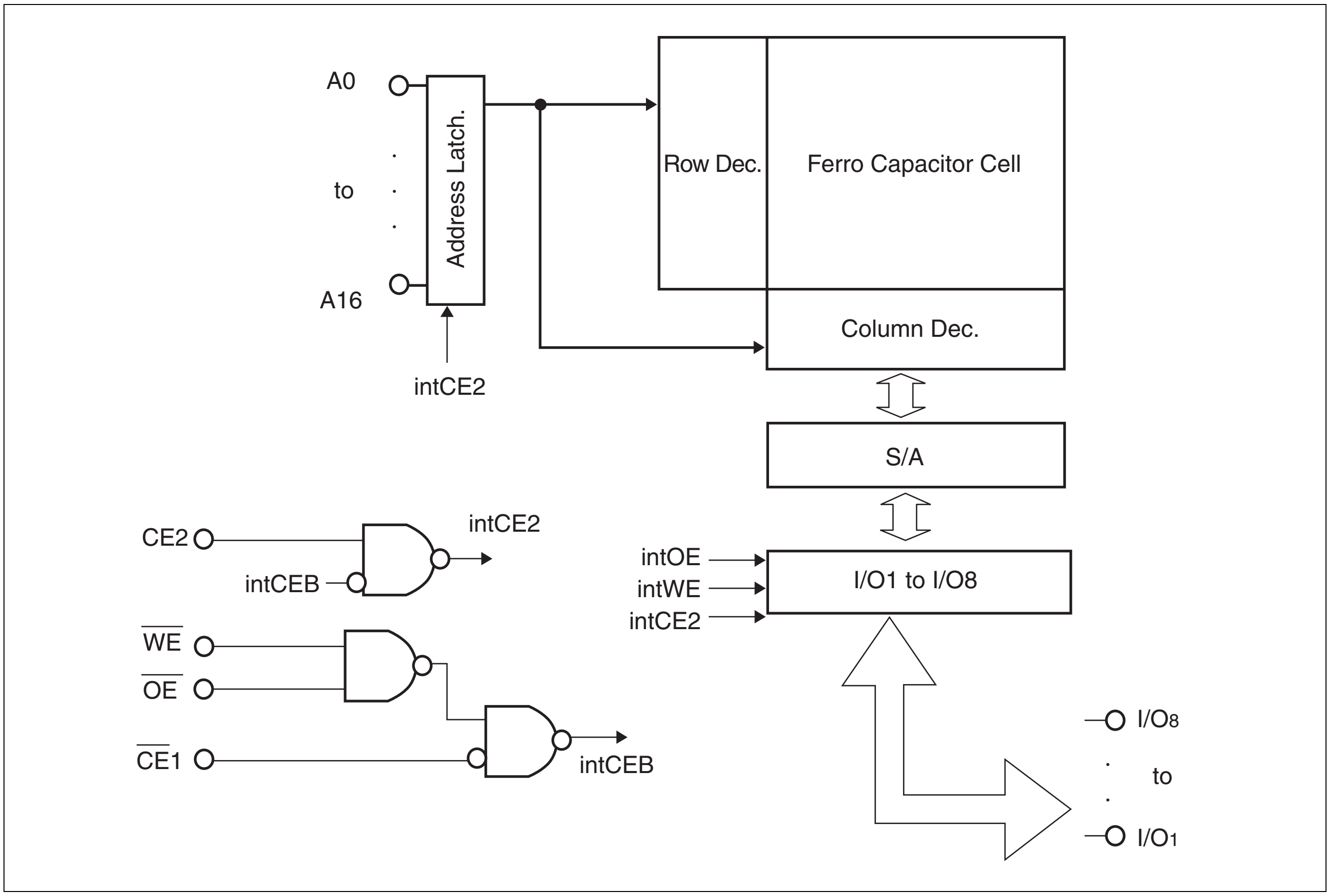
■ PIN ASSIGNMENTS



■ PIN DESCRIPTIONS

Pin name	Function
A0 to A16	Address In
I/O1 to I/O8	Data Input/Output
$\overline{\text{CE}}$1	Chip Enable 1 in
CE2	Chip Enable 2 in
$\overline{\text{WE}}$	Write Enable in
$\overline{\text{OE}}$	Output Enable in
V_{CC}	Power Supply
GND	Ground
NC	No Connection

■ BLOCK DIAGRAM



■ FUNCTION TRUTH TABLE

Operation Mode	$\overline{\text{CE1}}$	CE2	$\overline{\text{WE}}$	$\overline{\text{OE}}$	I/O$_1$ to I/O$_8$	Supply Current
Standby Pre-charge	H	X	X	X	High-Z	Standby (I$_{SB}$)
	X	L	X	X		
	X	X	H	H		
Read	↓ L	H ↑	H	L	Dout	Operation (I$_{CC}$)
Read (Pseudo-SRAM, $\overline{\text{OE}}$ control*1)	L	H	H	↓		
Write	↓ L	H ↑	L	H	Din	
Write (Pseudo-SRAM, $\overline{\text{WE}}$ control*2)	L	H	↓	H		

L = V$_{IL}$, H = V$_{IH}$, X can be either V$_{IL}$ or V$_{IH}$, High-Z = High Impedance

↓ : Latch address and latch data at falling edge, ↑ : Latch address and latch data at rising edge

*1 : $\overline{\text{OE}}$ control of the Pseudo-SRAM means the valid address at the falling edge of $\overline{\text{OE}}$ to read.

*2 : $\overline{\text{WE}}$ control of the Pseudo-SRAM means the valid address and data at the falling edge of $\overline{\text{WE}}$ to write.

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating		Unit
		Min	Max	
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
Ambient Operating Temperature	T_A	– 20	+ 85	°C
Storage Temperature	Tstg	– 40	+ 125	°C

* : All voltages are referenced to GND.

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	
Supply Voltage*	V_{CC}	3.0	3.3	3.6	V
Input Voltage (high)*	V_{IH}	V_{CC} × 0.8	—	V_{CC} + 0.5	V
Input Voltage (low)*	V_{IL}	– 0.5	—	+ 0.8	V
Operating Temperature	T_A	– 20	—	+ 85	°C

* : All voltages are referenced to GND.

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	Test Condition	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}, $\overline{\text{CE}}1 = V_{IH}$ or $\overline{\text{OE}} = V_{IH}$	—	—	10	µA
Operating Power Supply Current	I_{CC}	$\overline{\text{CE}}1$ = 0.2 V, CE2 = V_{CC}–0.2 V, I_{out} = 0 mA*1	—	10	15	mA
Standby Current	I_{SB}	$\overline{\text{CE}}1 \geq V_{CC}$–0.2 V	—	10	50	µA
		CE2 ≤ 0.2 V*2				
		$\overline{\text{OE}} \geq V_{CC}$–0.2 V, $\overline{\text{WE}} \geq V_{CC}$–0.2 V*2				
Output Voltage (high)	V_{OH}	I_{OH} = –2.0 mA	$V_{CC} \times 0.8$	—	—	V
Output Voltage (low)	V_{OL}	I_{OL} = 2.0 mA	—	—	0.4	V

*1 : During the measurement of I_{CC} , the Address, Data In were taken to only change once per active cycle.
I_{out} : output current

*2 : All pins other than setting pins should be input at the CMOS level voltages such as H ≥ V_{CC} – 0.2 V, L ≤ 0.2 V.

2. AC CHARACTERISTICS

• AC TEST CONDITIONS

Supply Voltage : 3.0 V to 3.6 V
Operating Temperature : −20 °C to +85 °C
Input Voltage Amplitude : 0.3 V to 2.7 V
Input Rising Time : 5 ns
Input Falling Time : 5 ns
Input Evaluation Level : 2.0 V / 0.8 V
Output Evaluation Level : 2.0 V / 0.8 V
Output Impedance : 50 pF

(1) Read Operation

(within recommended operating conditions)

Parameter	Symbol	Value		Unit
		Min	Max	
Read Cycle Time	t_{RC}	150	—	ns
$\overline{\text{CE}}$1 Active Time	t_{CA1}	120	—	ns
CE2 Active Time	t_{CA2}	120	—	ns
$\overline{\text{OE}}$ Active Time	t_{RP}	120	—	ns
Pre-charge Time	t_{PC}	20	—	ns
Address Setup Time	t_{AS}	0	—	ns
Address Hold Time	t_{AH}	50	—	ns
$\overline{\text{OE}}$ Setup Time	t_{ES}	0	—	ns
Output Hold Time	t_{OH}	0	—	ns
Output Set Time	t_{LZ}	30	—	ns
$\overline{\text{CE}}$1 Access Time	t_{CE1}	—	100	ns
CE2 Access Time	t_{CE2}	—	100	ns
$\overline{\text{OE}}$ Access Time	t_{OE}	—	100	ns
Output Floating Time	t_{OHZ}	—	20	ns

(2) Write Operation

(within recommended operating conditions)

Parameter	Symbol	Value		Unit
		Min	Max	
Write Cycle Time	t_{WC}	150	—	ns
$\overline{\text{CE}}$1 Active Time	t_{CA1}	120	—	ns
CE2 Active Time	t_{CA2}	120	—	ns
Pre-charge Time	t_{PC}	20	—	ns
Address Setup Time	t_{AS}	0	—	ns
Address Hold Time	t_{AH}	50	—	ns
Write Pulse Width	t_{WP}	120	—	ns
Data Setup Time	t_{DS}	0	—	ns
Data Hold Time	t_{DH}	50	—	ns
Write Setup Time	t_{WS}	0	—	ns

(3) Power ON/OFF Sequence

(within recommended operating conditions)

Parameter	Sym-bol	Value			Unit
		Min	Typ	Max	
$\overline{\text{CE}}$1 level hold time for Power OFF	t_{pd}	85	—	—	ns
$\overline{\text{CE}}$1 level hold time for Power ON	t_{pu}	85	—	—	ns

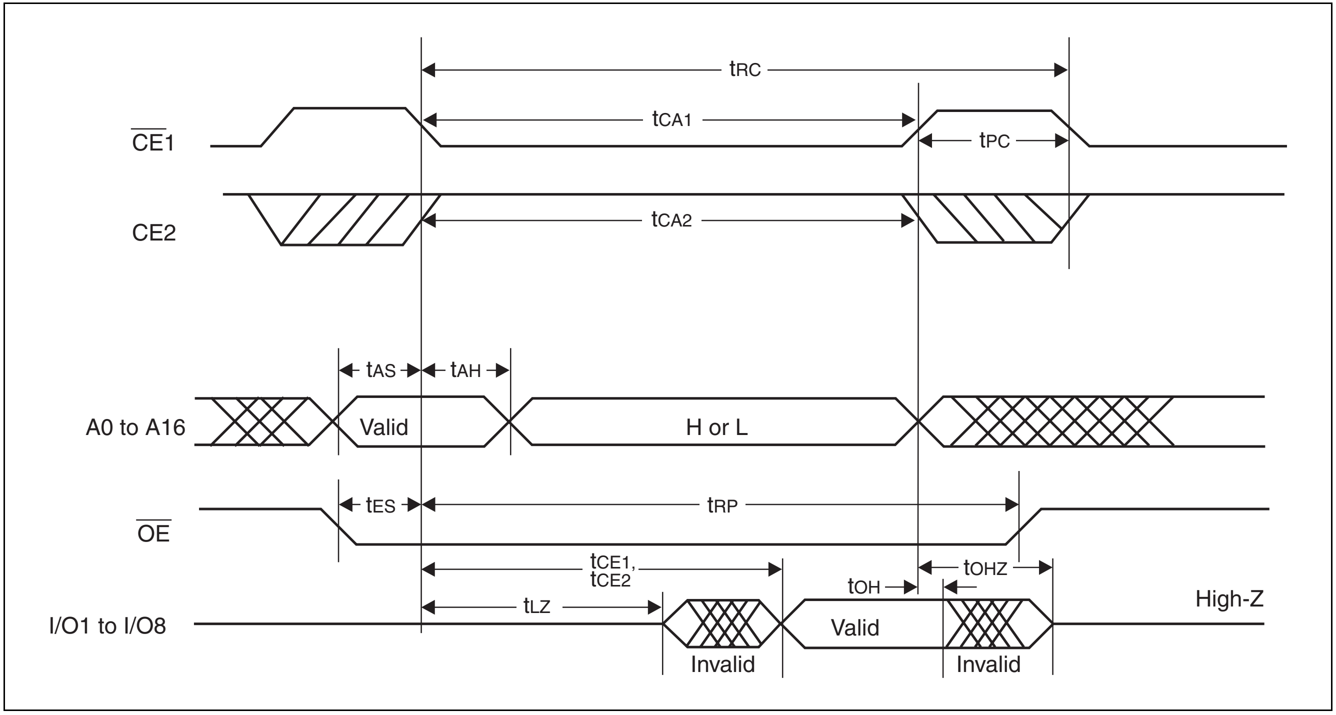
3. Pin Capacitance

(f = 1 MHz, T_A = +25 °C)

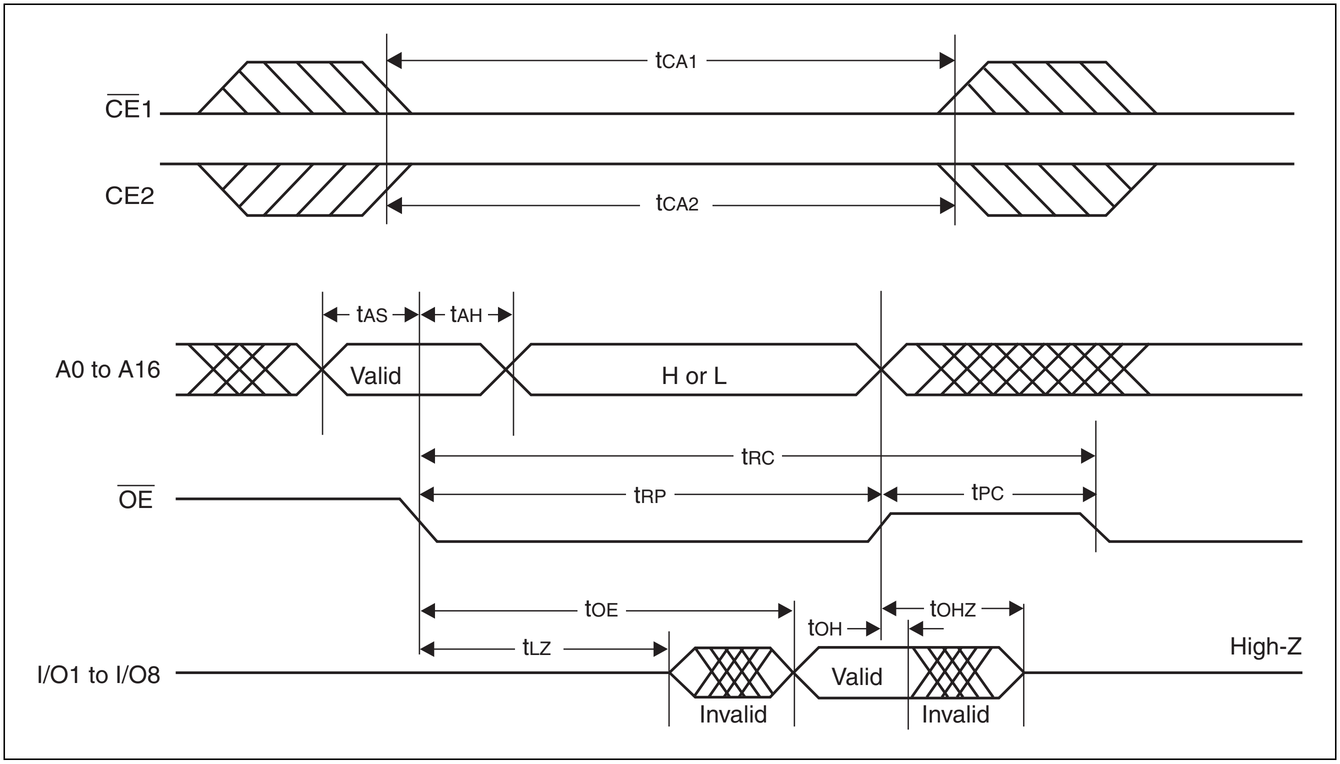
Parameter	Symbol	Test Condition	Value			Unit
			Min	Typ	Max	
Input Capacitance	C_{IN}	V_{IN} = GND	—	—	10	pF
Output Capacitance	C_{OUT}	V_{OUT} = GND	—	—	10	pF

■ TIMING DIAGRAMS

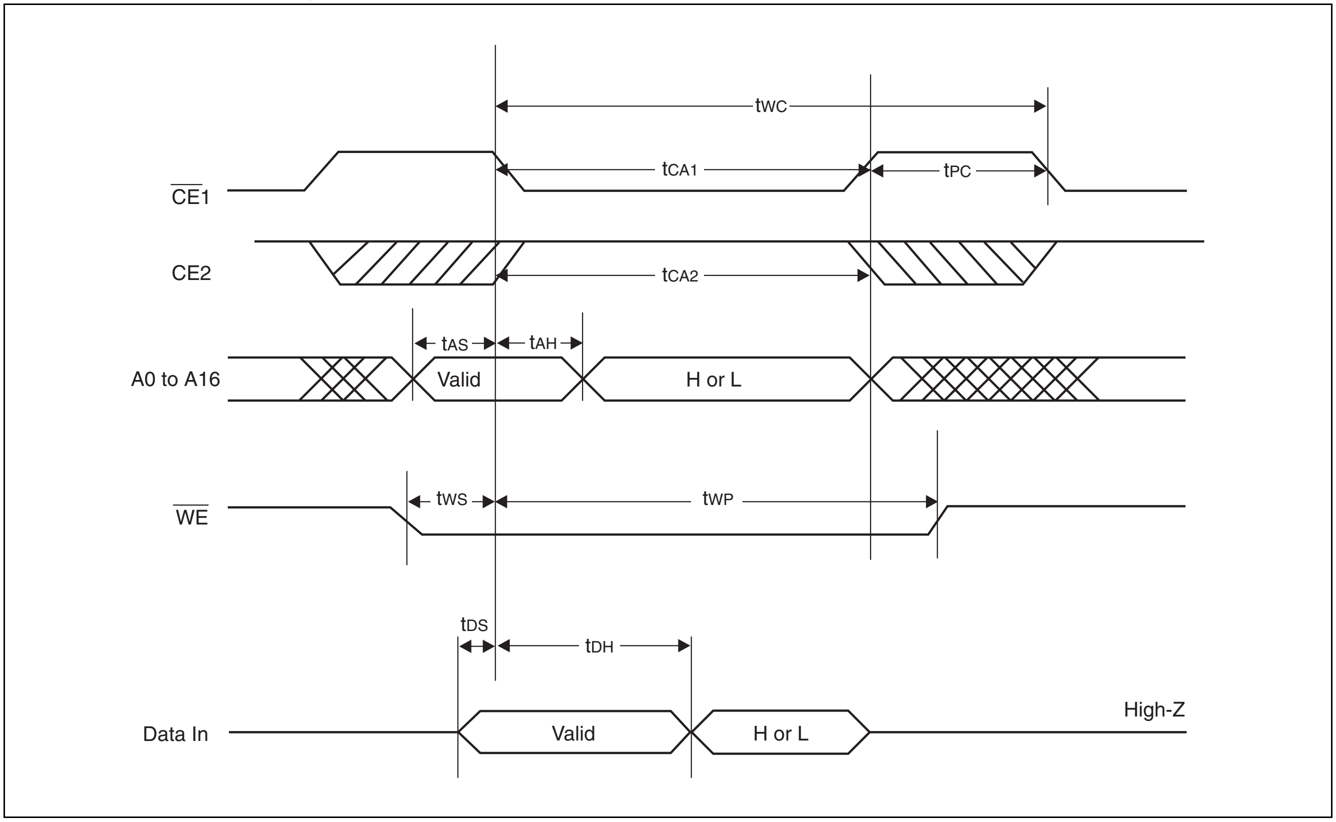
1. Read Cycle Timing ($\overline{\text{CE}}$1, CE2 Control)



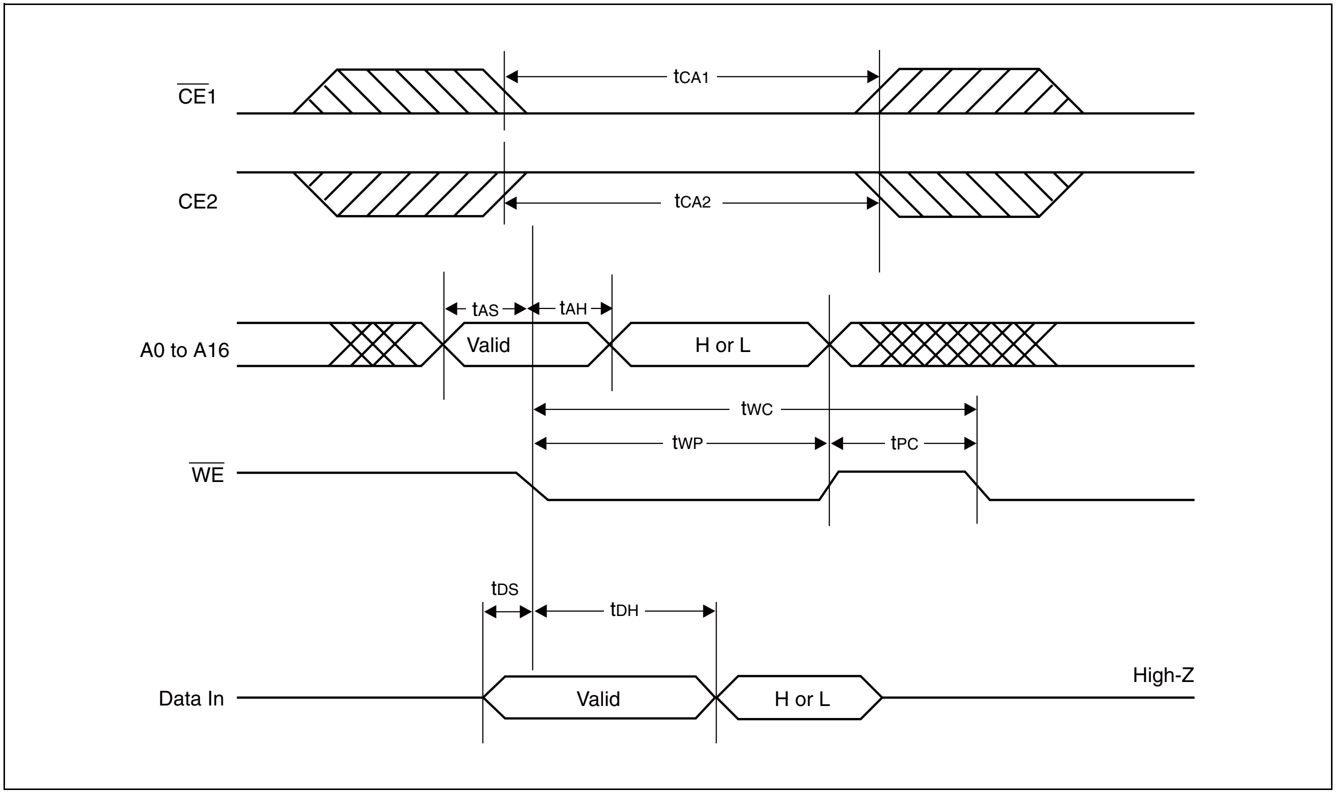
2. Read Cycle Timing ($\overline{\text{OE}}$ Control)



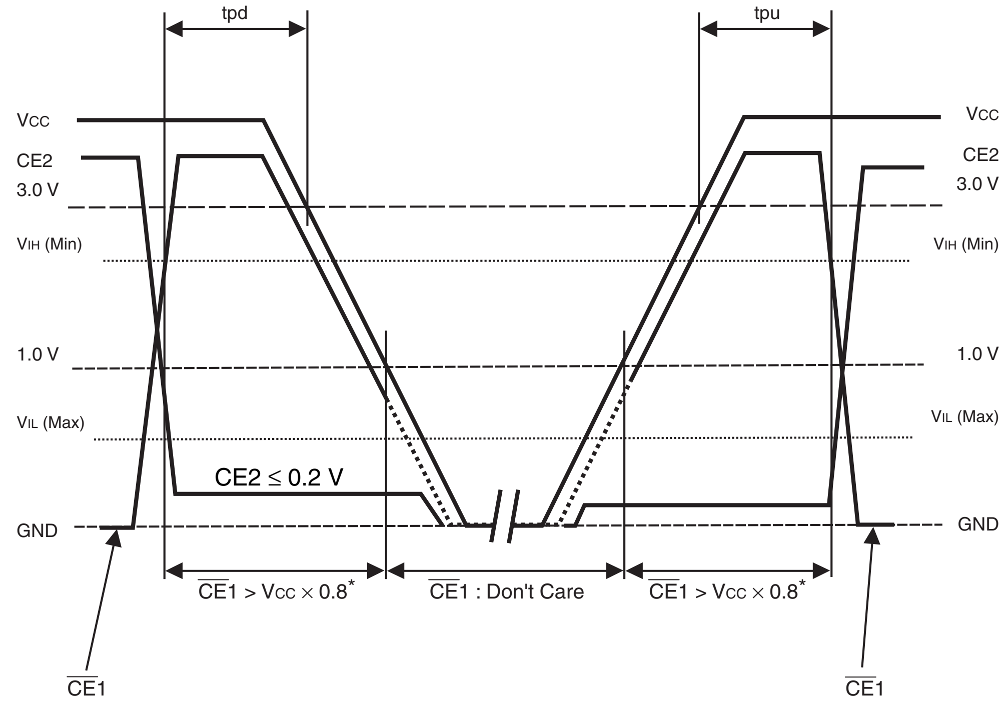
3. Write Cycle Timing ($\overline{\text{CE}}$1, CE2 Control)



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



■ POWER ON/OFF SEQUENCE



* : $\overline{CE}1$ (Max) < $V_{CC} + 0.5$ V

Note : You can choose either of $\overline{CE}1$ or CE2, or both for disenable control of the device.

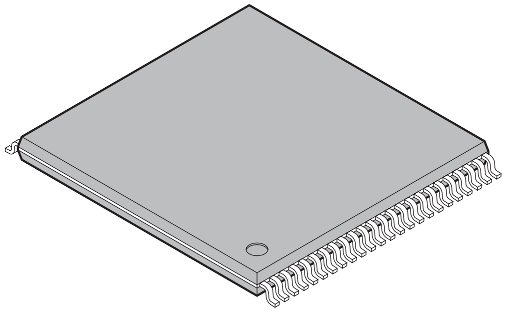
■ NOTES ON USE

Data that is written prior to IR reflow is not guaranteed to be retained after IR reflow.

■ ORDERING INFOMATION

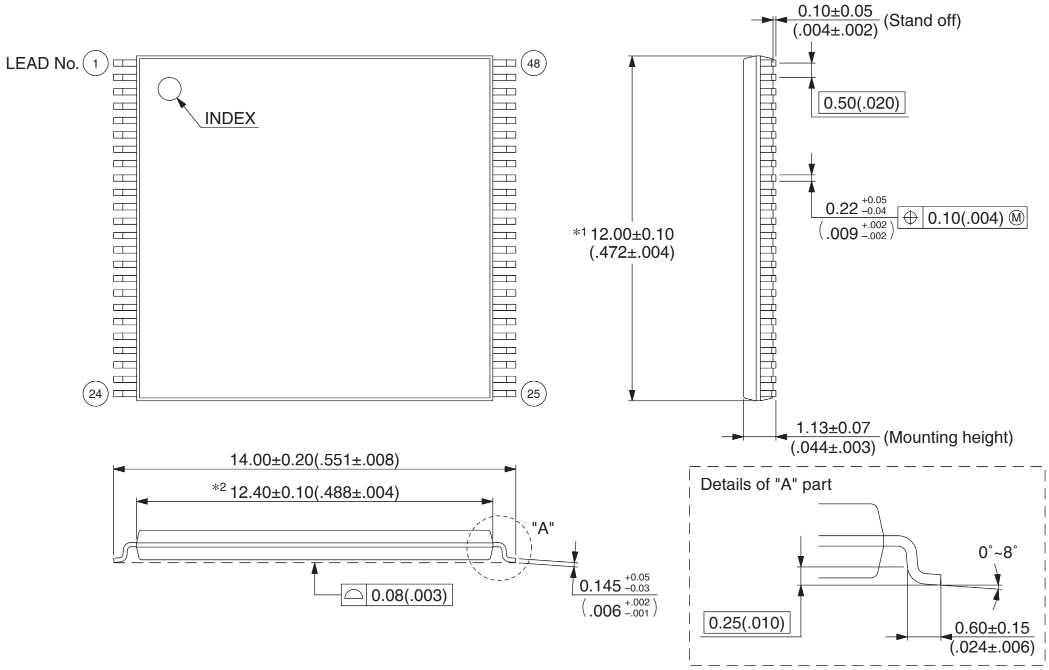
Part number	Package
MB85R1001PFTN-GE1	48-pin plastic TSOP(1) (FPT-48P-M25)

■ PACKAGE DIMENSIONS

48-pin plastic TSOP(1)  (FPT-48P-M25)	Lead pitch	0.50 mm
	Package width × package length	12.00 × 12.40 mm
	Lead shape	Gullwing
	Sealing method	Plastic mold
	Mounting height	1.20 mm MAX
	Weight	0.37 g
	Code (Reference)	P-TSOP(1)48-12×12.4-0.50

48-pin plastic TSOP(1)
(FPT-48P-M25)

Note 1) *1 : Resin protrusion. (Each side : +0.15 (.006) Max).
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

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

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