FUJITSU SEMICONDUCTOR
DATA SHEET

DS05-13103-2E

Memory FRAM

CMOS

1 M Bit (128 K × 8)

MB85R1001

■ DESCRIPTIONS

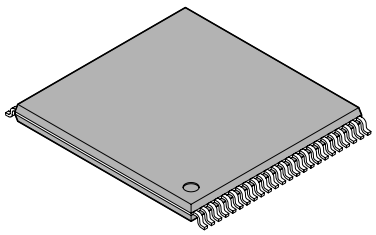
The MB85R1001 is an FRAM (Ferroelectric Random Access Memory) chip in a configuration of 131,072 words x 8 bits, using the ferroelectric process and silicon gate CMOS process technologies for forming the nonvolatile memory cells.
Unlike SRAM, MB85R1001 is able to retain data without back-up battery.
The memory cells used for the MB85R1001 has improved at least 10^{10} times of read/write access, significantly outperforming FLASH memory and E^2PROM in endurance.
The MB85R1001 used a pseudo - SRAM interface compatible with conventional asynchronous SRAM.

■ FEATURES

- Bit configuration : 131,072 words x 8bits
- Read/write endurance : 10^{10} times
- Operating power supply voltage : 3.0 V to 3.6 V
- Operating temperature range : -20 °C to +85 °C
- 48-pin, TSOP (1) plastic package

■ PACKAGE

48-pin plastic TSOP(1)



(FPT-48P-M25)

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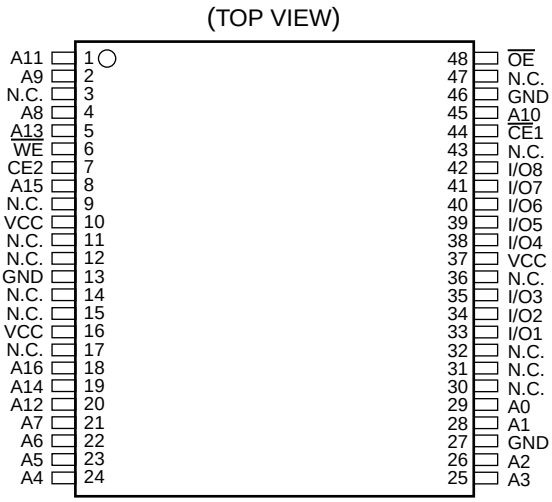
■ PIN ASSIGNMENTS

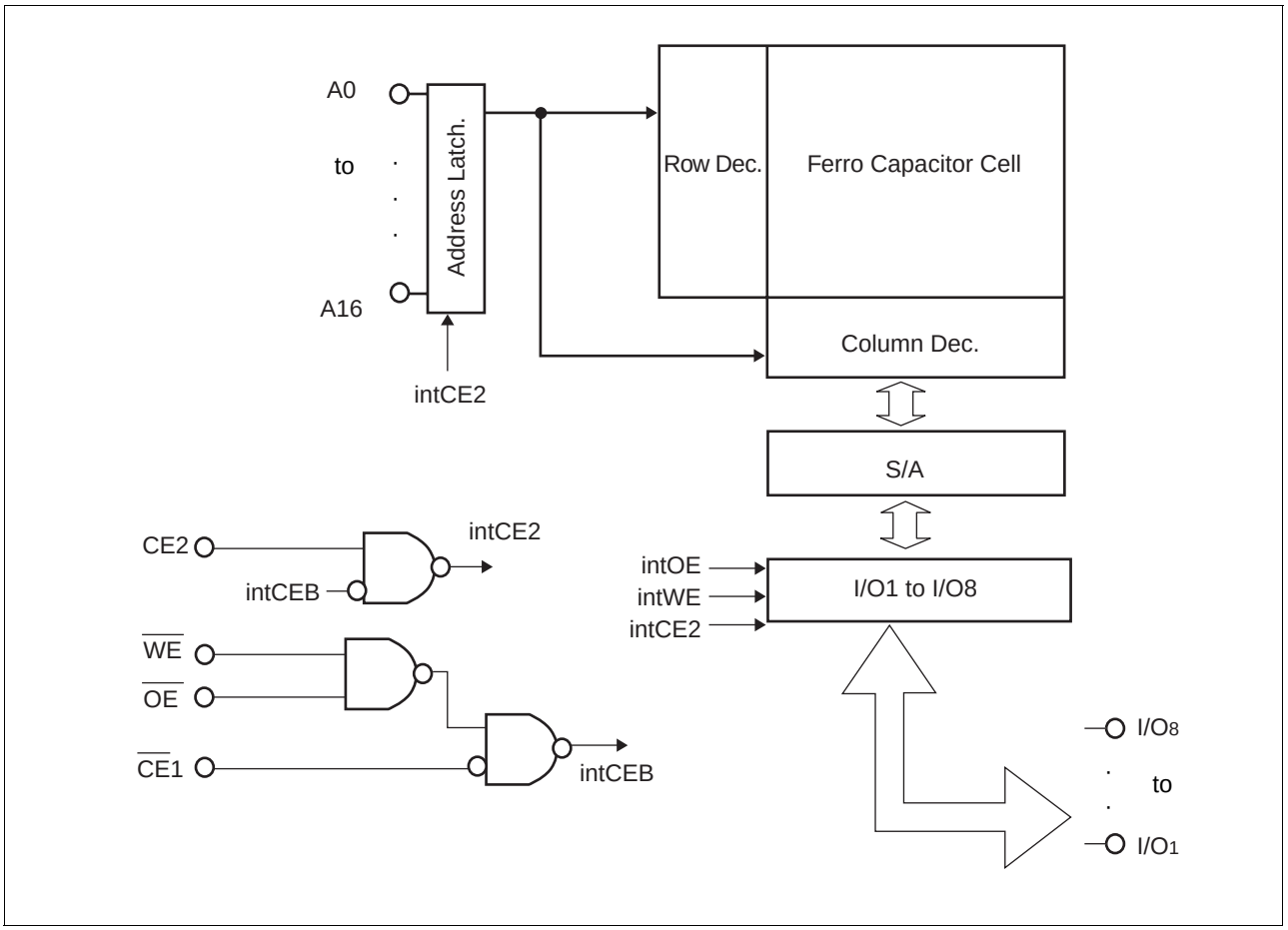


(FPT-48P-M25)

■ PIN DESCRIPTIONS

Pin name	Function
A0 to A16	Address In
I/O1 to I/O8	Data Input/Output
$\overline{CE}$1	Chip Enable 1 in
CE2	Chip Enable 2 in
$\overline{WE}$	Write Enable in
$\overline{OE}$	Output Enable in
VCC	Power Supply
GND	Ground

■ BLOCK DIAGRAM



■ FUNCTION TRUTH TABLE

Operation Mode	$\overline{CE1}$	CE2	$\overline{WE}$	$\overline{OE}$	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, $\overline{OE}$ control)	L	H	H	↓		
Write	↓ L	H ↑	L	H	Din	
Write (Pseudo SRAM, $\overline{WE}$ control)	L	H	↓	H		
Output Disable	L	H	H	H	High-Z	

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

↓ : Latch address at falling edge, ↑ : Latch address at rising edge

■ 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 Temperature	T_A	–20	+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

(V_{CC} = 3.0 V to 3.6 V, T_A = –20 °C to +85 °C)

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} x 0.8	—	V_{CC} + 0.5	V
Input Voltage (low)	V_{IL}	–0.5	—	0.8	V
Operating Temperature	T_A	–20	—	+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

(V_{CC} = 3.0 V to 3.6 V, T_A = –20 °C to +85 °C)

Parameter	Symbol	Test Condition	Value			Unit
			Min	Typ	Max	
Input Leakage Current	$\|I_{LI}\|$	V_{IN} = 0 V to V_{CC}	—	—	10	µA
Output Leakage Current	$\|I_{LO}\|$	V_{OUT} = 0 V to V_{CC}, $\overline{CE}1$ = V_{IH} or $\overline{OE}$ = V_{IH}	—	—	10	µA
Supply Current	I_{CC}	$\overline{CE}1$ = 0.2 V, CE2 = V_{CC}–0.2 V, I_{out} = 0 mA*1	—	—	10	mA
Standby Current	I_{SB}	$\overline{CE}1$ ≥ V_{CC}–0.2 V	—	10	100	µA
		CE2 ≤ 0.2 V*2				
		$\overline{OE}$ ≥ V_{CC}–0.2 V, $\overline{WE}$ ≥ V_{CC}–0.2 V*2				
Output Voltage (high)	V_{OH}	I_{OH} = –2.0 mA	0.8 x V_{CC}	—	—	V
Output Voltage (low)	V_{OL}	I_{OL} = 2.0 mA	—	—	0.4	V

*1 : I_{out} : Output current

*2 : All other inputs ($\overline{CE}1$, CE2, $\overline{OE}$, $\overline{WE}$) should be at CMOS levels, i.e., 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	: 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 Impedance	: 50 pF

(1) Read Operation

(V_{CC} = 3.0 V to 3.6 V, T_A = –20 °C to +85 °C)

Parameter	Symbol	Value		Unit
		Min	Max	
Read Cycle Time	t_{RC}	250	—	ns
$\overline{CE}$1 Active Time	t_{CA1}	210	2,000	ns
$\overline{OE}$ Active Time	t_{RP}	210	2,000	ns
Pre-charge Time	t_{PC}	40	—	ns
Address Setup Time	t_{AS}	10	—	ns
Address Hold Time	t_{AH}	50	—	ns
$\overline{OE}$ Setup Time	t_{ES}	10	—	ns
$\overline{CE}$1 Access Time	t_{CE1}	—	100	ns
CE2 Access Time	t_{CE2}	—	100	ns
$\overline{OE}$ Access Time	t_{OE}	—	100	ns
$\overline{OE}$ Output Floating Time	t_{OHZ}	—	25	ns

(2) Write Operation

(V_{CC} = 3.0 V to 3.6 V, T_A = –20 °C to +85 °C)

Parameter	Symbol	Value		Unit
		Min	Max	
Write Cycle Time	t_{WC}	250	—	ns
$\overline{CE}$1 Active Time	t_{CA1}	210	2,000	ns
CE2 Active Time	t_{CA2}	210	2,000	ns
Pre-charge Time	t_{PC}	40	—	ns
Address Setup Time	t_{AS}	10	—	ns
Address Hold Time	t_{AH}	50	—	ns
Write Pulse Width	t_{WP}	210	—	ns
Data Setup Time	t_{DS}	10	—	ns
Data Hold Time	t_{DH}	50	—	ns
Write Setup Time	t_{WS}	0	—	ns

(3) Power ON/OFF Sequence

Parameter	Sym-bol	Value			Units
		Min	Typ	Max	
$\overline{CE}$1 LEVEL holding time in Power OFF	t_{pd}	85	—	—	ns
$\overline{CE}$1 LEVEL holding time in Power ON	t_{pu}	85	—	—	ns
Power interval *	t_{pi}	0.5	—	—	s

* : Condition for power detection circuit to function

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

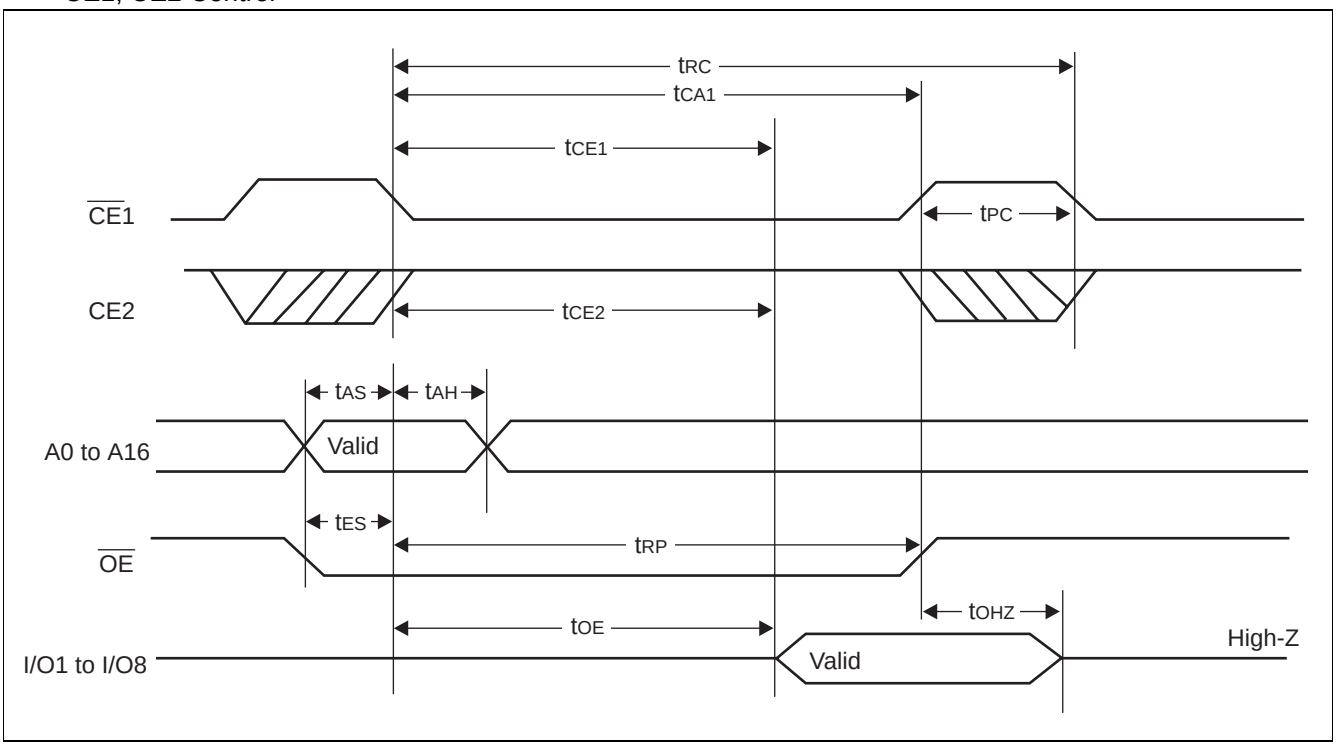
4. Reliability

Data retention 10 years (T_A = 0 °C to +55 °C)
Access endurance 10^{10} times (T_A = –20 °C to +85 °C)

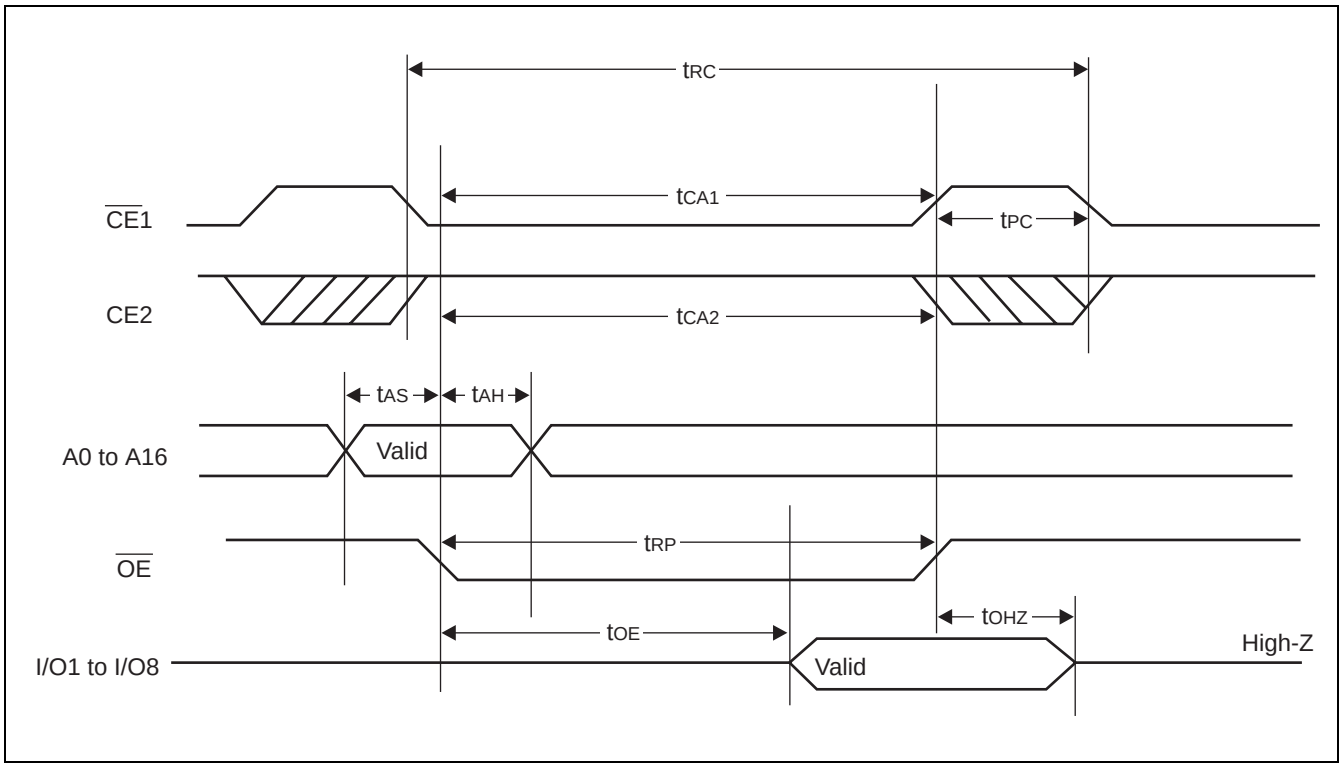
■ TIMING DIAGRAMS

1. Read Cycle Timing

• $\overline{CE}$1, CE2 Control

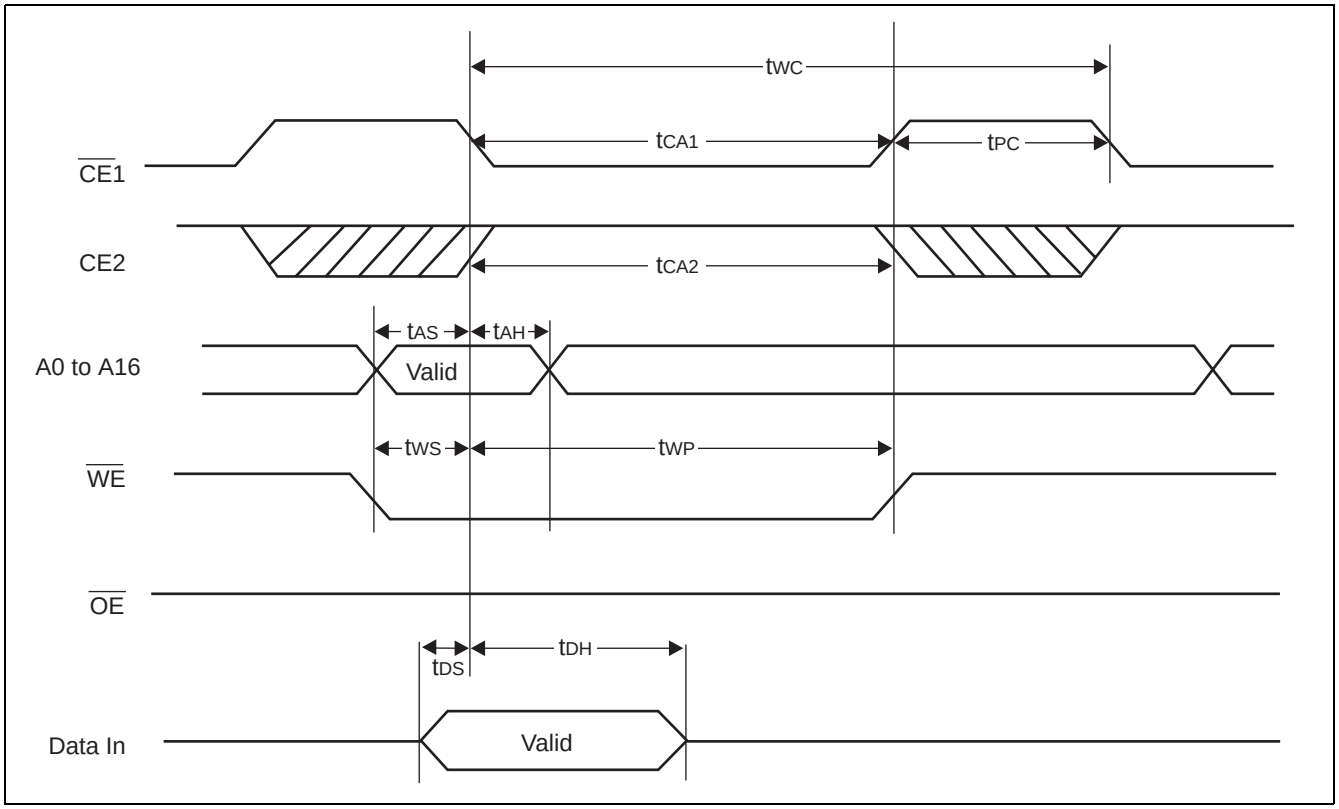


• $\overline{OE}$ Control

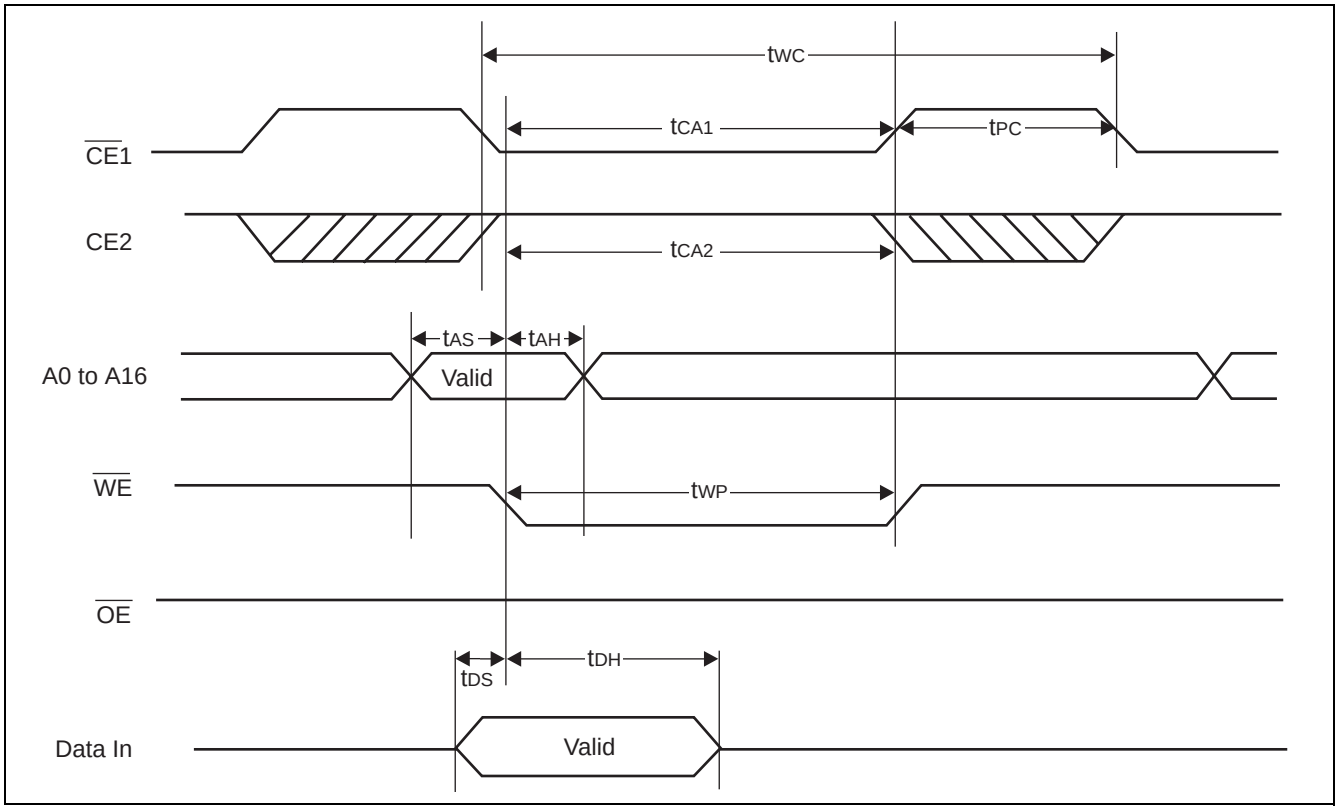


2. Write Cycle Timing

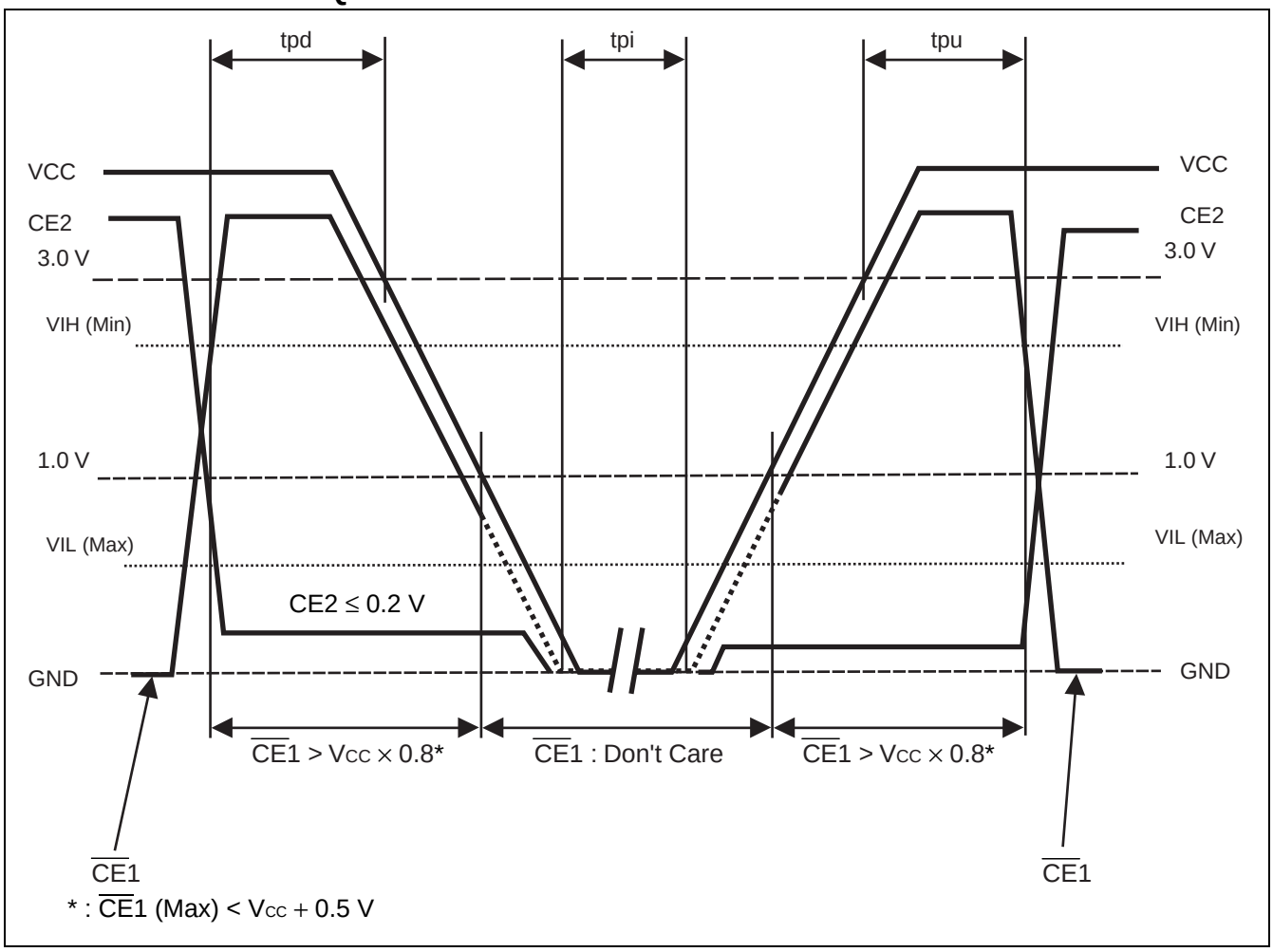
• $\overline{CE}$1, CE2 Control



• $\overline{WE}$ Control



■ POWER ON/OFF SEQUENCE



■ NOTES ON USE

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

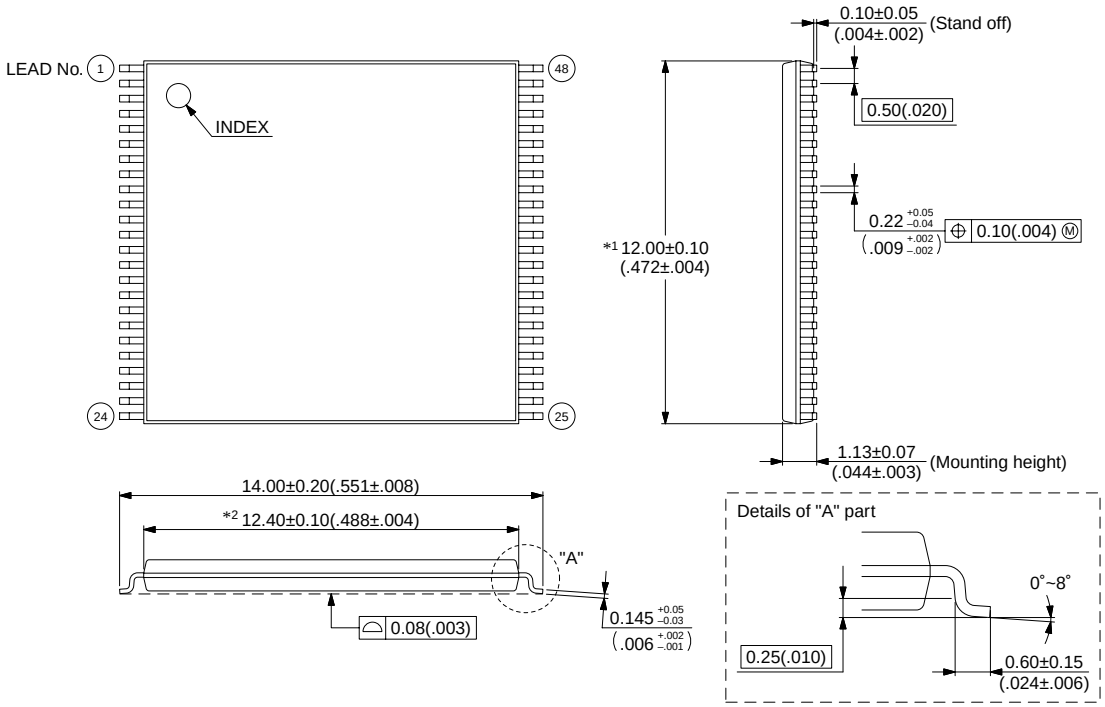
■ ORDERING INFOMATION

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

■ PACKAGE DIMENTION

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.

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