FUJITSU SEMICONDUCTOR
DATA SHEET

DS501-00011-1v0-E

Memory FRAM

256 K (32 K × 8) Bit

MB85R256F

■ DESCRIPTIONS

The MB85R256F is an FRAM (Ferroelectric Random Access Memory) chip in a configuration of 32,768 words × 8 bits, using the ferroelectric process and silicon gate CMOS process technologies for forming the nonvolatile memory cells.

The MB85R256F is able to retain data without using a back-up battery, as is needed for SRAM.

The memory cells used in the MB85R256F can be used for 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 MB85R256F uses a pseudo - SRAM interface compatible with conventional asynchronous SRAM.

■ FEATURES

- Bit configuration : 32,768 words × 8 bits
- High endurance 10 Billion Read/writes
- Peripheral circuit CMOS construction
- Operating power supply voltage : 2.7 V to 3.6 V
- Operating temperature range : −40 °C to +85 °C
- Data retention : 10 years (+55 °C)
- Package : 28-pin, SOP flat package
  : 28-pin, TSOP(1) flat package

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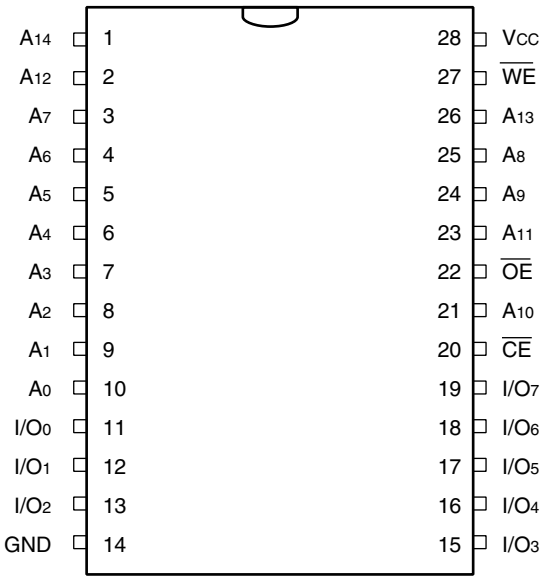
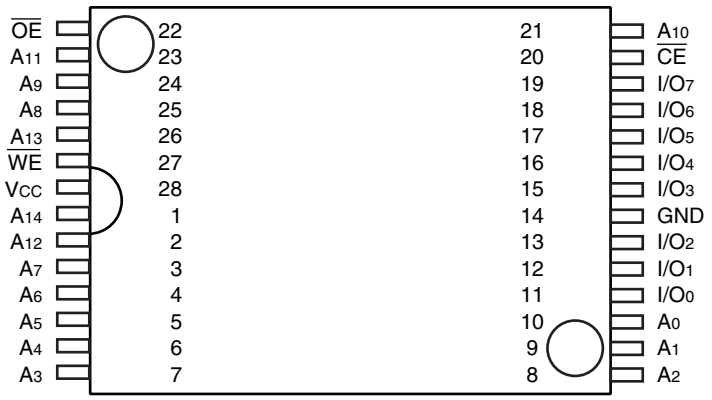
■ PIN ASSIGNMENTS

(TOP VIEW)



(FPT-28P-M17)

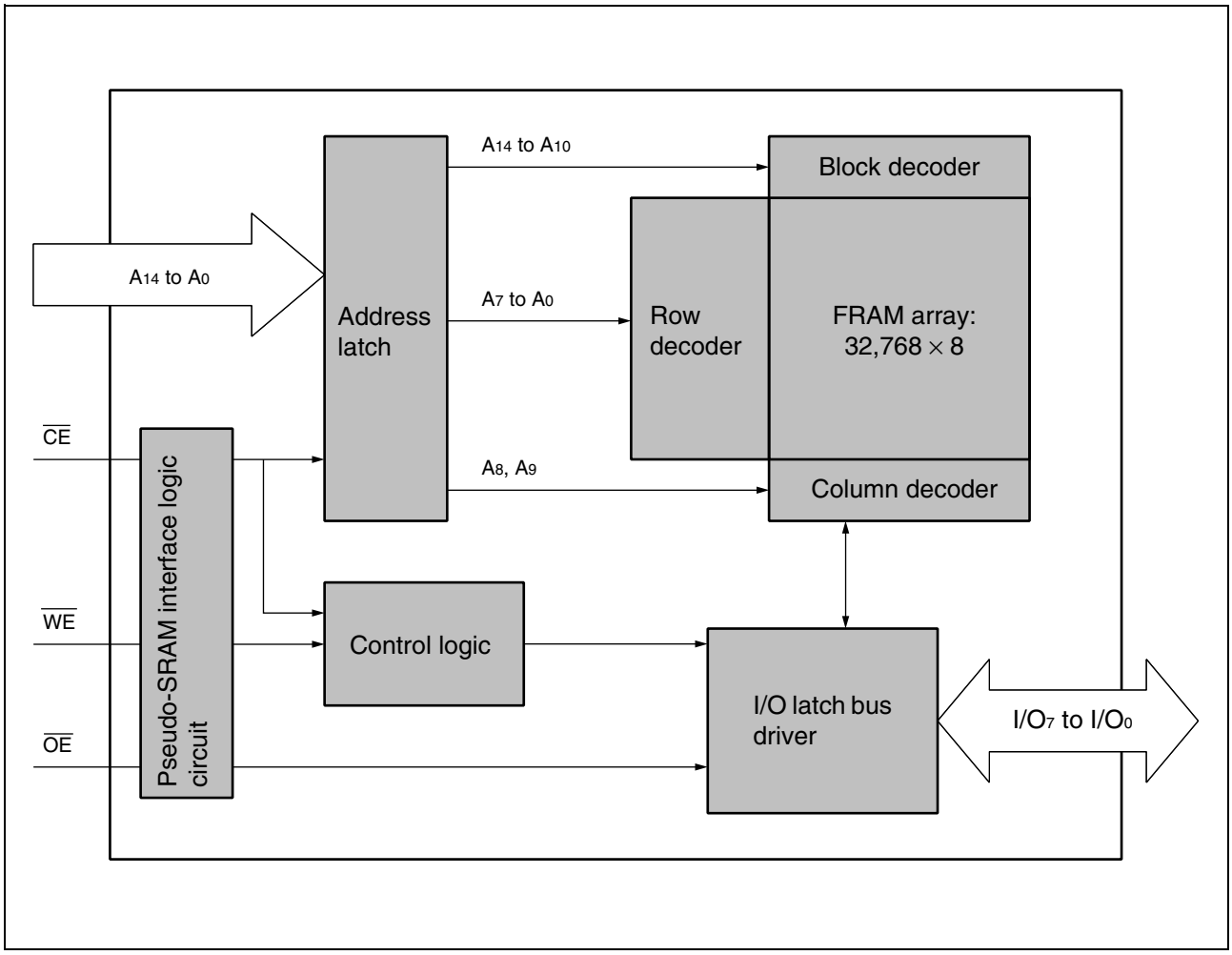


(FPT-28P-M19)

■ PIN FUNCTIONAL DESCRIPTIONS

Pin no.	Pin name	Functional description
1 to 10, 21, 23 to 26	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_0 to I/O_7	Power supply current
Standby precharge	H	×	×	Hi-Z	Standby (I_{SB})
	×	L	L		
	×	H	H		
Latch address	L	↓	↓	—	—
	↓	H	L		
	↓	L	H		
Write	L	L	H	Data input	Operation (I_{CC})
Read	L	H	L	Data output	

H: High level, L: Low level, × : 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

* : These parameters are based on the condition that V_{SS} is 0 V.

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}	$V_{CC} \times 0.8$	—	V_{CC} + 0.5	V
Low level input voltage*	V_{IL}	− 0.5	—	+ 0.6	V
Operating temperature	T_A	− 40	—	+ 85	°C

* : These parameters are based on the condition that V_{SS} is 0 V.

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	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	50	µA
High level output voltage	V_{OH}	I_{OH} = – 2.0 mA	V_{CC} × 0.8	—	—	V
Low level output voltage	V_{OL}	I_{OL} = 2.0 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	500	
Read pulse width	t_{RP}	70	500	
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	500	
Write pulse width	t_{WP}	70	500	
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. 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

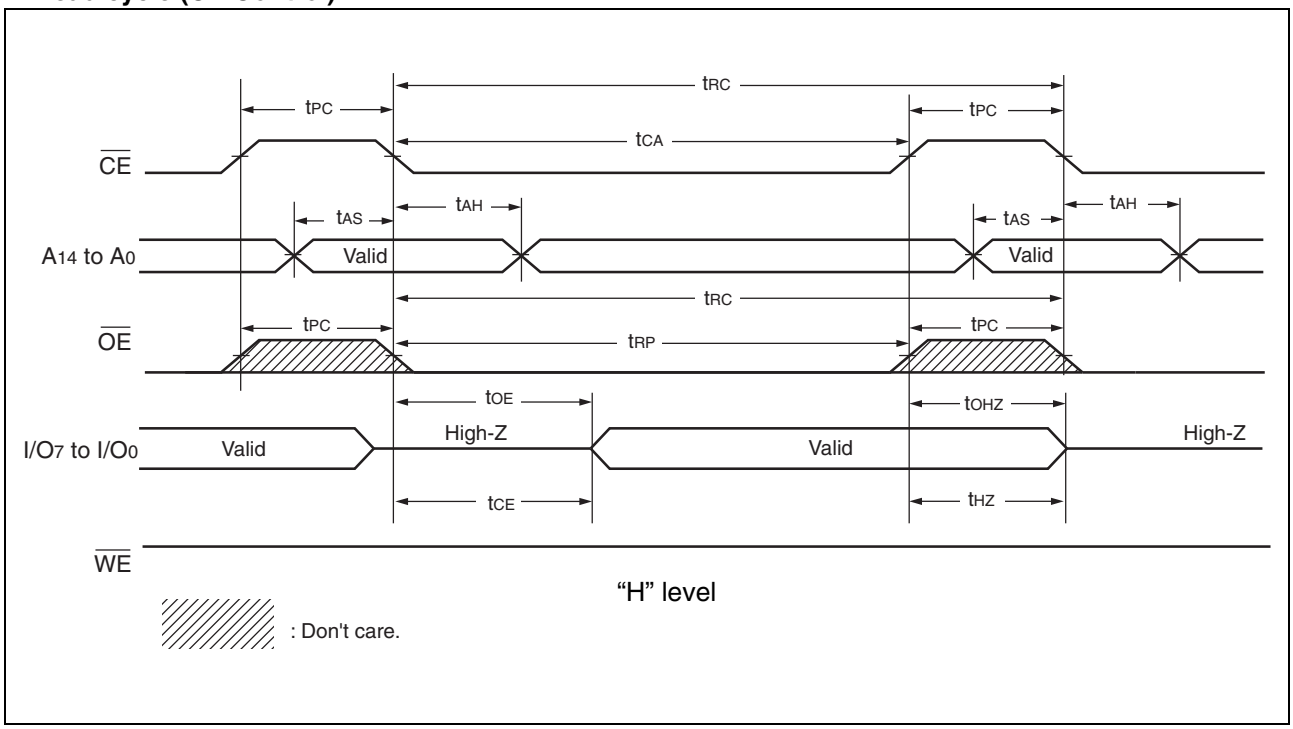
Input evaluation level: Vcc/2

Output evaluation level: Vcc/2

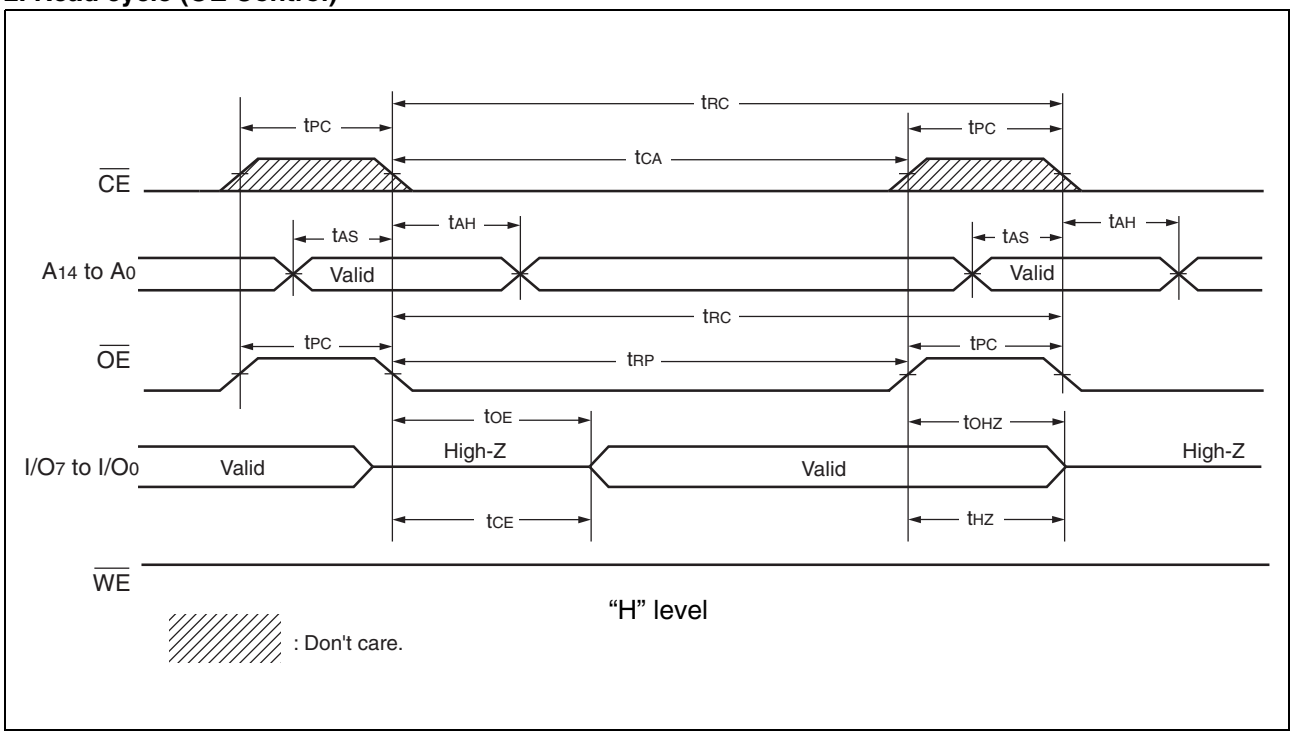
Output load: 100 pF

■ TIMING DIAGRAM

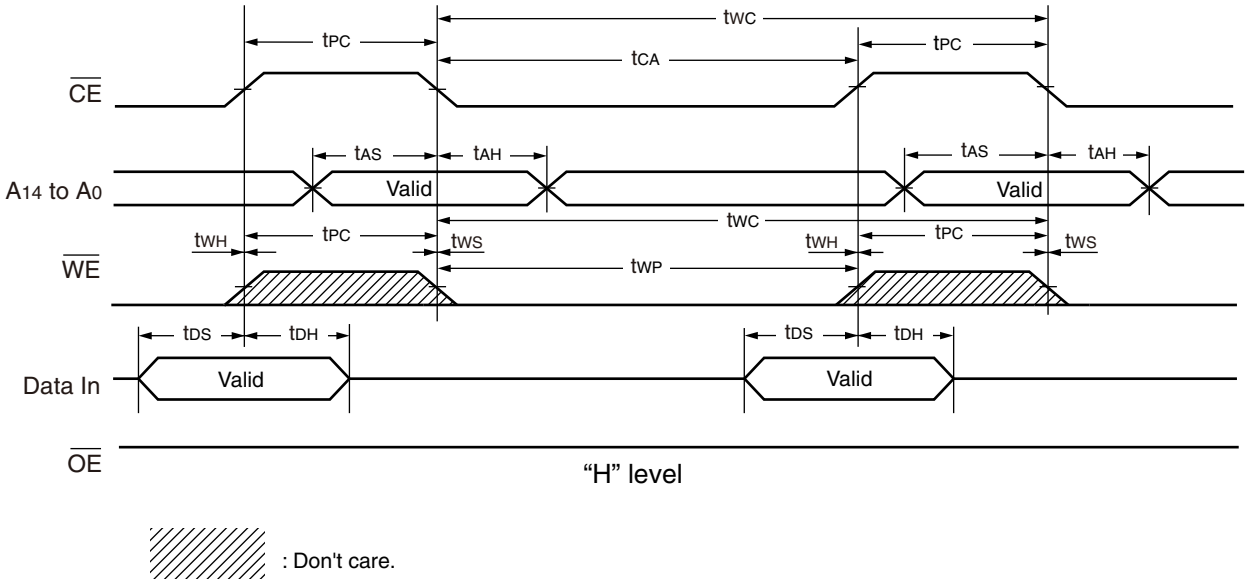
1. Read cycle ($\overline{CE}$ Control)



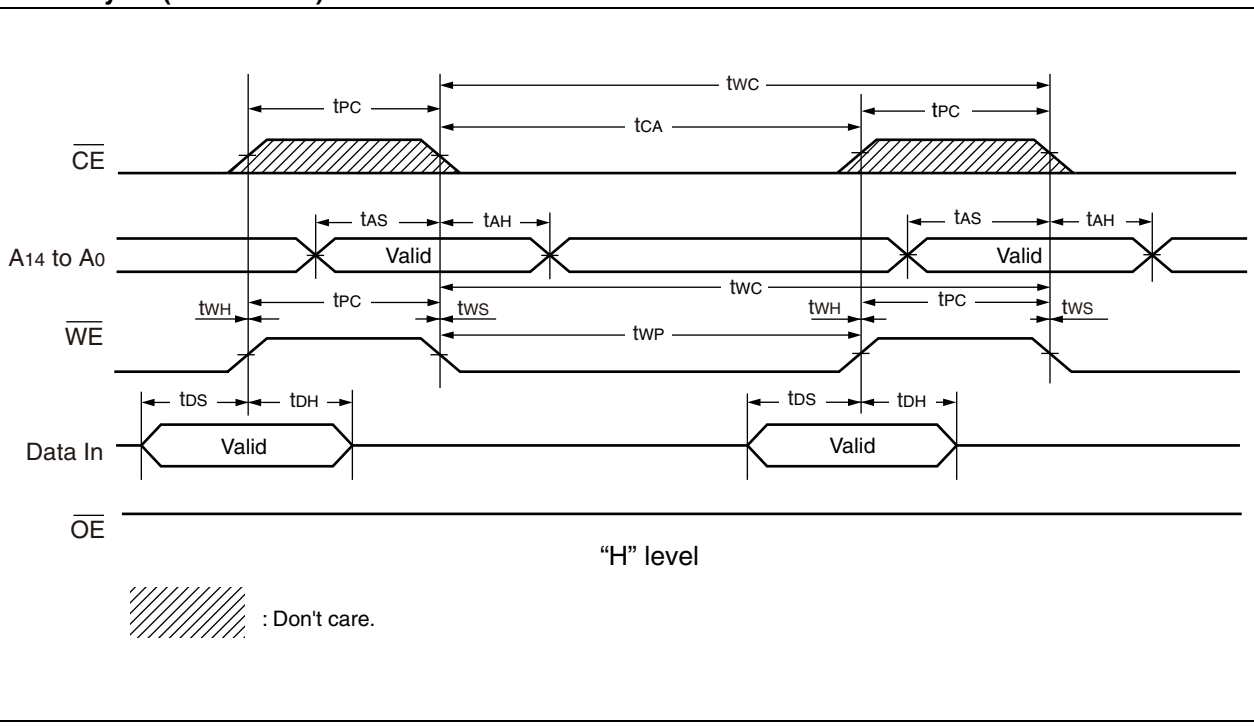
2. Read cycle ($\overline{OE}$ Control)



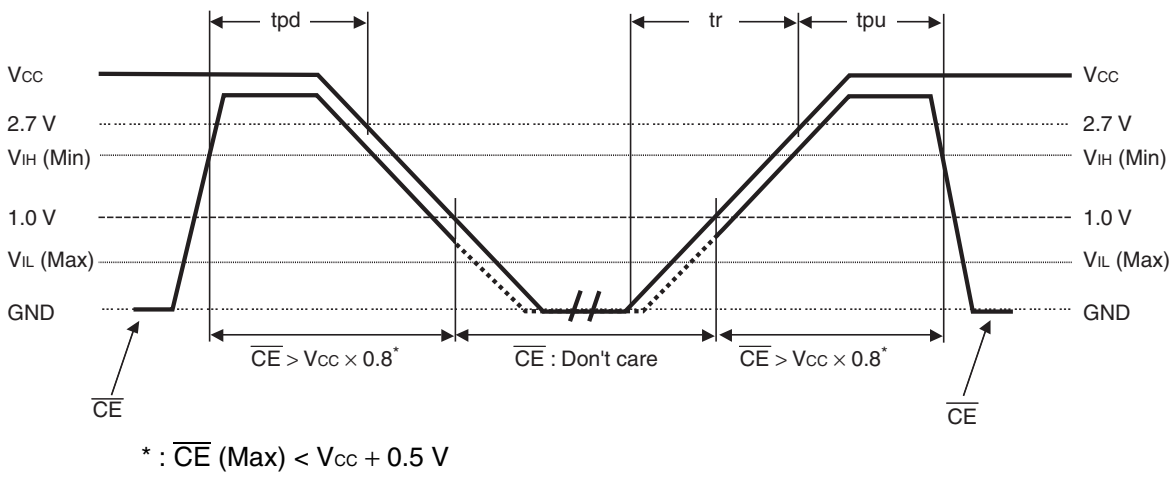
3. Write cycle ($\overline{CE}$ Control)



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



■ POWER ON/OFF SEQUENCE



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

Notes: • Because turning the power-on from an intermediate level cause malfunction, when the power is turned on, V_{CC} is required to be started from 0 V.

• If the device does not operate within the specified conditions of read cycle, write cycle, power on/off sequence, memory data can not be guaranteed.

(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 supply rising time	tr	0.05	—	200	ms

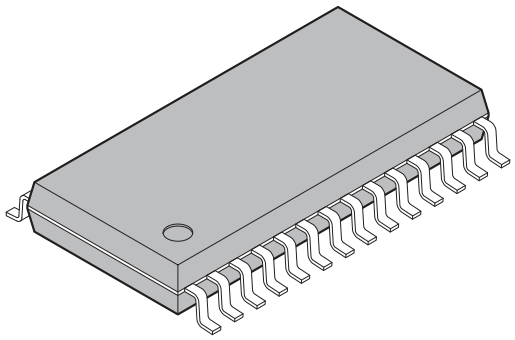
■ NOTES ON USE

After the IR reflow completed, it is not guaranteed to save the data written prior to the IR reflow.

■ ORDERING INFORMATION

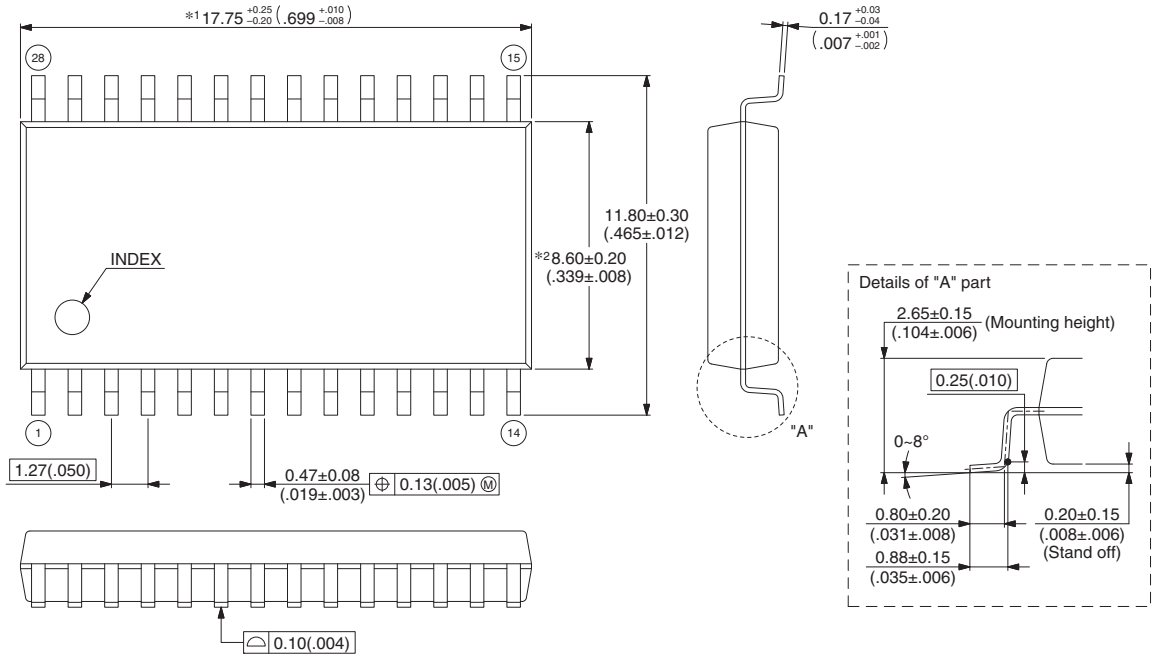
Part number	Package	Remarks
MB85R256FPF-G-BNDE1	28-pin plastic SOP (FPT-28P-M17)	
MB85R256FPFCN-G-BNDE1	28-pin plastic TSOP(1) (FPT-28P-M19)	
MB85R256FPF-G-BND-ERE1	28-pin plastic SOP (FPT-28P-M17)	Embossed carrier tape

■ PACKAGE DIMENSIONS

28-pin plastic SOP		
	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
(FPT-28P-M17)	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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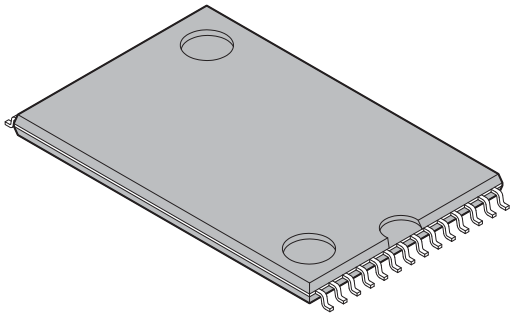
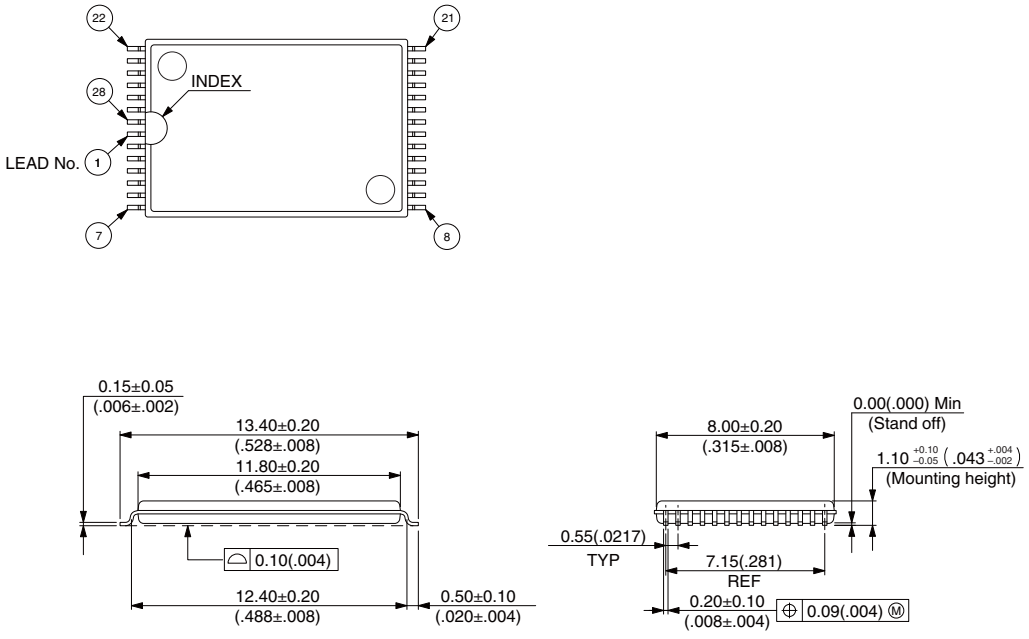
28-pin plastic TSOP (1)		
	Lead pitch	0.55 mm
	Package width × package length	11.80 × 8.00 mm
	Lead shape	Gullwing
	Sealing method	Plastic mold
	Mounting height	1.20 mm Max
	Weight	Approx. 0.25 g
(FPT-28P-M19)	Code (Reference)	P-TSOP(1)28-11.8×8-0.55

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



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

MEMO

MEMO

FUJITSU SEMICONDUCTOR LIMITED

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Edited: Sales Promotion Department