Memory FRAM cмos 2 M Bit (128 K × 16)

MB85R2002

■ DESCRIPTIONS

The MB85R2002 is an FRAM (Ferroelectric Random Access Memory) chip consisting of 131,072 words \times 16 bits of non-volatile memory cells created using ferroelectric process and silicon gate CMOS process technologies. The MB85R2002 is able to retain data without using a back-up battery, as is needed for SRAM. The memory cells used in the MB85R2002 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 E²PROM. The MB85R2002 uses a pseudo-SRAM interface that is compatible with conventional asynchronous SRAM.

■ FEATURES

• Bit configuration : 131,072 words × 16 bits

Read/write endurance : 10¹⁰ times/bit
 Operating power supply voltage : 3.0 V to 3.6 V
 Operating temperature range : -40 °C to +85 °C
 Data retention : 10 years (+55 °C)

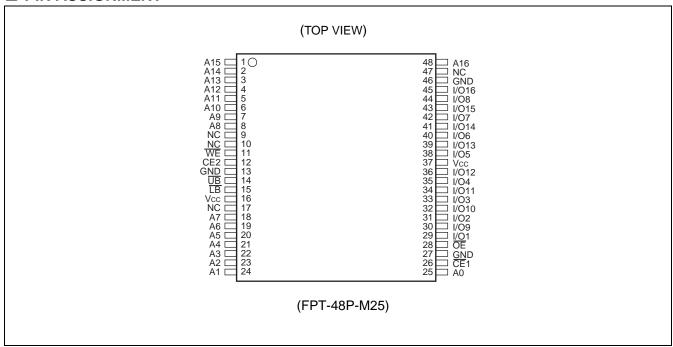
• LB and UB data byte control

• Package : 48-pin plastic TSOP (1)



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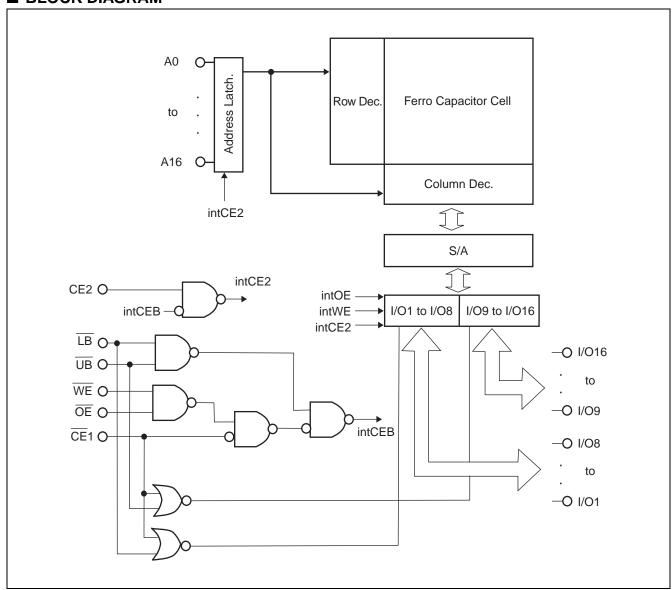
■ PIN ASSIGNMENT



■ PIN DESCRIPTION

Pin name	Function	
A0 to A16	Address Input	
I/O1 to I/O16	Data Input/Output	
CE1	Chip Enable 1 Input	
CE2	Chip Enable 2 Input	
WE	Write Enable Input	
ŌĒ	Output Enable Input	
ĪB, ŪB	Data Byte Control Input	
Vcc	Power Supply	
GND	Ground	
NC	No Connection	

■ BLOCK DIAGRAM



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■ FUNCTION TRUTH TABLE

Mode	CE ₁	CE2	WE	ŌĒ	LB	ŪB	I/O1 to I/O8	I/O9 to I/O16	Supply Current
	Н	Χ	XX	Х	Χ	Х			
Standby Pre-charge	Х	L	Х	Х	Х	Х	∐iah 7	High-Z	Standby
Standby Fre-charge	Х	Х	Н	Н	Х	Х	High-Z	riigii-Z	(Isb)
	Х	Х	Х	Х	Н	Н			
					L	L	Dout	Dout	
Read	l ₹ L	H	Н	L	L	Н	Dout	High-Z	
	_	_			Н	L	High-Z	Dout	
Read					L	L	Dout	Dout	
(Pseudo-SRAM,	L	Н	Н	¥	L	Н	Dout	High-Z	
OE control*1)					Н	L	High-Z	Dout	Operation
	_				L	L	Din	Din	(Icc)
Write	L L	H	L	Х	L	Н	Din	High-Z	
	_	_^			Н	L	High-Z	Din	
Write					L	L	Din	Din	
(Pseudo-SRAM,	L	Н	¥	Н	L	Н	Din	High-Z	
WE control*2)					Н	L	High-Z	Din	

 $L=V_{IL},\,H=V_{IH},\,X\,\,can\,\,be\,\,either\,\,V_{IL}\,\,or\,\,V_{IH},\,High-Z=High\,\,Impedance\\ \begin{array}{c} \\ \searrow \end{array}\,\,:\,Latch\,\,address\,\,and\,\,latch\,\,data\,\,at\,\,rising\,\,edge \end{array}$

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

 $^{^{\}star}2$: $\overline{\text{WE}}$ 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	Ra	Unit	
Farameter	Symbol	Min	Max	Onit
Supply Voltage*	Vcc	-0.5	+4.0	V
Input Voltage*	Vin	-0.5	Vcc + 0.5	V
Output Voltage*	Vouт	-0.5	Vcc + 0.5	V
Ambient Operating Temperature	TA	-40	+85	°C
Storage Temperature	T _{stg}	-40	+125	°C

^{* :} All voltages are referenced to GND = 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

their representatives beforehand.

Parameter	Symbol		Unit		
Parameter	Symbol	Min	Тур	Max	Onit
Supply Voltage*	Vcc	3.0	3.3	3.6	V
Input Voltage (high)*	ViH	Vcc × 0.8		Vcc + 0.5	V
Input Voltage (low)*	VIL	-0.5		+0.6	V
Ambient Operating Temperature	TA	- 40	_	+85	°C

^{* :} All voltages are referenced to GND = 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

■ ELECTRICAL CHARACTERISTICS

1. DC CHARACTERISTICS

(within recommended operating conditions)

Parameter	Symbol	ol Conditions		Value		
Faranielei	Syllibol	Conditions	Min	Тур	Max	Unit
Input Leakage Current	 Li	V _{IN} = 0 V to V _{CC}	_		10	μΑ
Output Leakage Current	ILO	Vout = 0 V to Vcc, $\overline{CE}1 = V_{IH}$ or $\overline{OE} = V_{IH}$		_	10	μΑ
Supply Current	Icc	$\overline{\text{CE}}1 = 0.2 \text{ V}, \text{ CE}2 = \text{Vcc} - 0.2 \text{ V}, \text{ lout} = 0 \text{ mA*}^{1}$	_	10	15	mA
		CE1 ≥ Vcc – 0.2 V				
Standby Current	Isa	CE2 ≤ 0.2 V*2		10	50	μΑ
Stariuby Current	128	$\overline{OE} \ge Vcc - 0.2 \text{ V}, \overline{WE} \ge Vcc - 0.2 \text{ V}^{*2}$		10	30	μΛ
		$\overline{LB} \ge Vcc - 0.2 \text{ V}, \overline{UB} \ge Vcc - 0.2 \text{ V}^{*2}$				
Output Voltage (high)	Vон	$I_{OH} = -2.0 \text{ mA}$	$Vcc \times 0.8$			V
Output Voltage (low)	Vol	lol = 2.0 mA			0.4	V

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

2. AC CHARACTERISTICS

• AC TEST CONDITIONS

Supply Voltage: 3.0 V to 3.6 V

Operating Temperature : -40 °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	Va	Value			
rai ailletei	Syllibol	Min	Max	Unit		
Read Cycle time	trc	150	_	ns		
CE1 Active Time	t _{CA1}	120		ns		
CE2 Active Time	t _{CA2}	120	_	ns		
OE Active Time	t RP	120	_	ns		
LB, UB Active Time	t BP	120	_	ns		
Pre-charge Time	t PC	20	_	ns		
Address Setup Time	tas	5	_	ns		
Address Hold Time	t ah	50	_	ns		
OE Setup Time	tes	5	_	ns		
LB, UB Setup Time	t _{BS}	5	_	ns		
Output Data Hold time	tон	0	_	ns		
Output Set Time	t _{LZ}	30	_	ns		
CE1 Access Time	t _{CE1}	_	100	ns		
CE2 Access Time	t _{CE2}	_	100	ns		
OE Access Time	t oe		100	ns		
Output Floating Time	tонz	_	20	ns		

^{*2 :} All pins other than setting pins should be input at the CMOS level voltages such as $H \ge V_{CC} - 0.2 \text{ V}$, $L \le 0.2 \text{ V}$.

(2) Write Operation

(within recommended operating conditions)

Parameter	Symbol	Val	lue	Unit
Farameter	Syllibol	Min	Max	- Offic
Write Cycle Time	twc	150	—	ns
CE1 Active Time	t _{CA1}	120	_	ns
CE2 Active Time	t _{CA2}	120	_	ns
LB, UB Active Time	t BP	120	_	ns
Pre-Charge Time	t PC	20		ns
Address Setup Time	tas	5		ns
Address Hold Time	t ah	50	_	ns
LB, UB Setup Time	t BS	5	_	ns
Write Pulse Width	t wp	120	_	ns
Data Setup Time	tos	0		ns
Data Hold Time	tон	50	—	ns
Write Setup Time	tws	5		ns

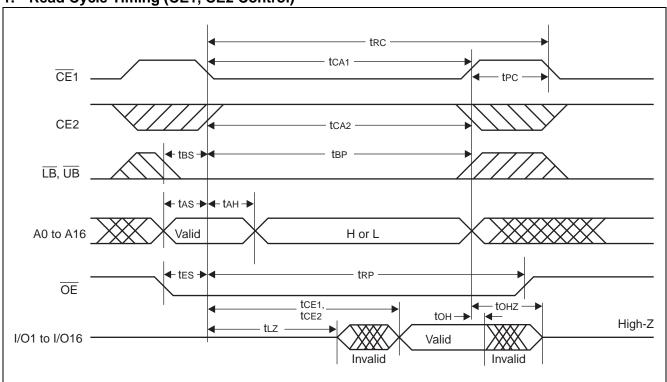
3. Pin Capacitance

Parameter	Symbol	Condition		Value		Unit
raiailletei	Syllibol	Condition	Min	Тур	Max	Oilit
Input Capacitance	Cin	VIN = VOUT = GND	_	_	10	pF
Output Capacitance	Соит	f = 1 MHz, T _A = +25 °C		_	10	pF

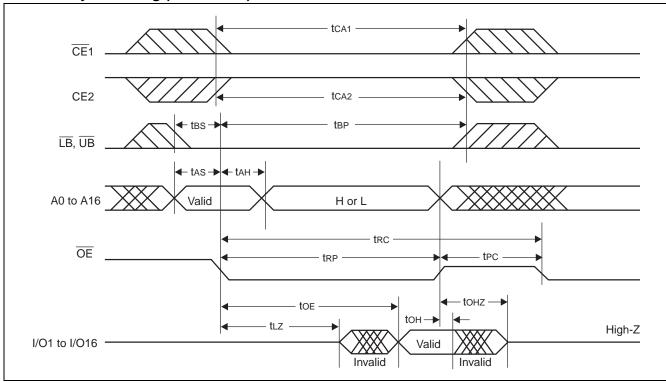
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■ TIMING DIAGRAMS

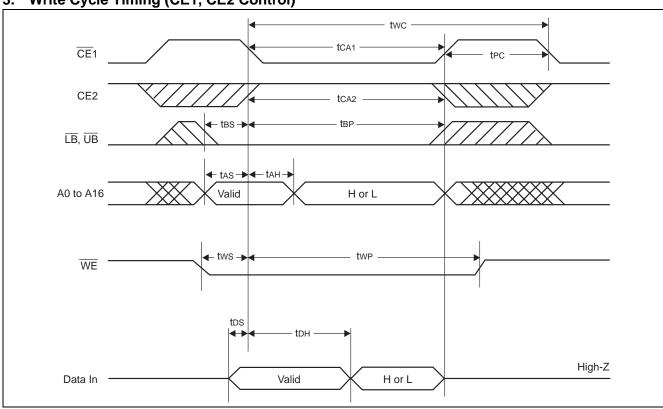
1. Read Cycle Timing (CE1, CE2 Control)



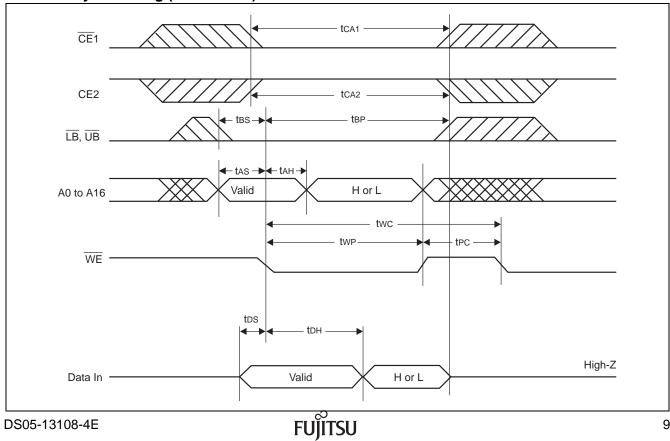
2. Read Cycle Timing (OE Control)



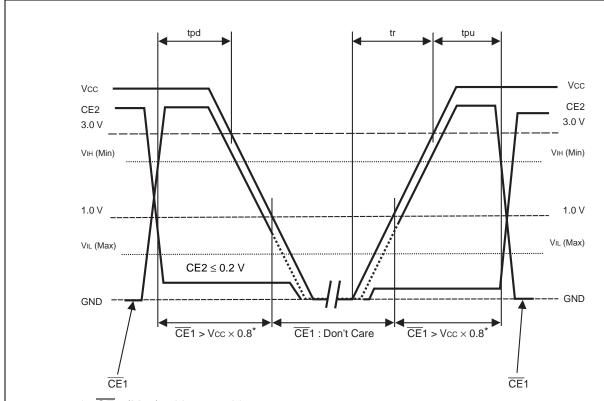
3. Write Cycle Timing (CE1, CE2 Control)



4. Write Cycle Timing (WE Control)



■ POWER ON/OFF SEQUENCE



*: CE1 (Max) < Vcc + 0.5 V

Notes: • Use either of CE1 or CE2, or both for disenable control of the device.

- ullet Because turning the power on from an intermediate level may cause malfunctions, 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		Unit		
Farameter	Syllibol	Min	Тур	Max	Oilit
CE1 LEVEL hold time for Power OFF	t pd	85	_	_	ns
CE1 LEVEL hold time for Power ON	t pu	85		_	ns
Power supply rising time	tr	0.05		200	ms

■ NOTES ON USE

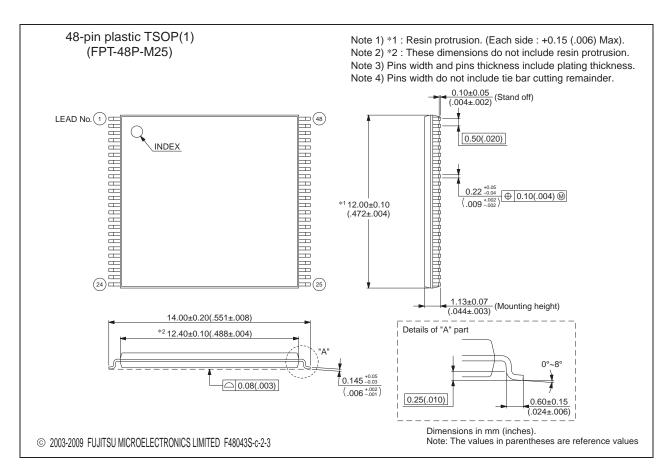
After the IR reflow completed, it is not guaranteed to save the data written prior to the IR reflow.

■ ORDERING INFOMATION

Part number	Package
MB85R2002PFTN-GE1	48-pin plastic TSOP(1) (FPT-48P-M25)

■ PACKAGE DIMENSIONS

48-pin plastic TSOP(1)	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
(FPT-48P-M25)	Code (Reference)	P-TSOP(1)48-12×12.4-0.50



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

FUJITSU MICROELECTRONICS LIMITED

Shinjuku Dai-Ichi Seimei Bldg., 7-1, Nishishinjuku 2-chome, Shinjuku-ku, Tokyo 163-0722, Japan

Tel: +81-3-5322-3329 http://jp.fujitsu.com/fml/en/

For further information please contact:

North and South America

FUJITSU MICROELECTRONICS AMERICA, INC. 1250 E. Arques Avenue, M/S 333
Sunnyvale, CA 94085-5401, U.S.A.
Tel: +1-408-737-5600 Fax: +1-408-737-5999
http://www.fma.fujitsu.com/

Europe

FUJITSU MICROELECTRONICS EUROPE GmbH Pittlerstrasse 47, 63225 Langen, Germany Tel: +49-6103-690-0 Fax: +49-6103-690-122 http://emea.fujitsu.com/microelectronics/

Korea

FUJITSU MICROELECTRONICS KOREA LTD. 206 Kosmo Tower Building, 1002 Daechi-Dong, Gangnam-Gu, Seoul 135-280, Republic of Korea Tel: +82-2-3484-7100 Fax: +82-2-3484-7111 http://kr.fujitsu.com/fmk/

Asia Pacific

FUJITSU MICROELECTRONICS ASIA PTE. LTD. 151 Lorong Chuan, #05-08 New Tech Park 556741 Singapore Tel: +65-6281-0770 Fax: +65-6281-0220 http://www.fmal.fujitsu.com/

FUJITSU MICROELECTRONICS SHANGHAI CO., LTD. Rm. 3102, Bund Center, No.222 Yan An Road (E), Shanghai 200002, China Tel: +86-21-6146-3688 Fax: +86-21-6335-1605 http://cn.fujitsu.com/fmc/

FUJITSU MICROELECTRONICS PACIFIC ASIA LTD. 10/F., World Commerce Centre, 11 Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: +852-2377-0226 Fax: +852-2376-3269

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