# Memory FRAM

# 1 M Bit (128 $K \times 8$ )

# MB85R1001A

#### **■ DESCRIPTIONS**

The MB85R1001A is an FRAM (Ferroelectric Random Access Memory) chip consisting of 131,072 words  $\times$  8 bits of nonvolatile memory cells fabricated using ferroelectric process and silicon gate CMOS process technologies.

The MB85R1001A is able to retain data without using a back-up battery, as is needed for SRAM.

The memory cells used in the MB85R1001A can be used for 10<sup>10</sup> read/write operations, which is a significant improvement over the number of read and write operations supported by Flash memory and E<sup>2</sup>PROM.

The MB85R1001A uses a pseudo-SRAM interface that is compatible with conventional asynchronous SRAM.

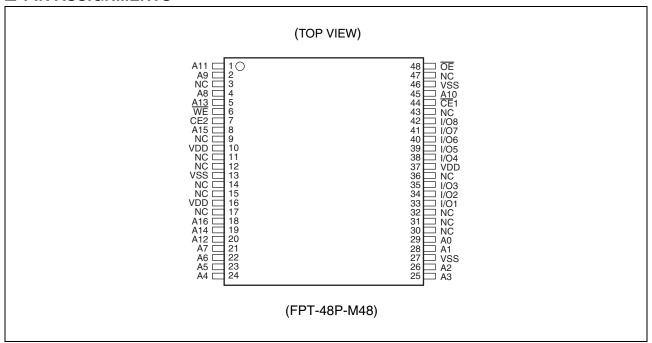
#### **■ FEATURES**

• Bit configuration : 131,072 words × 8 bits

Read/write endurance : 10<sup>10</sup> times
 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)
 Package : 48-pin plastic TSOP (1)



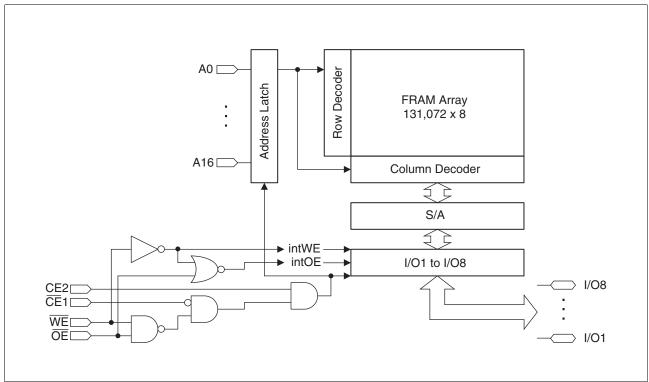
## **■ PIN ASSIGNMENTS**



## **■ PIN DESCRIPTIONS**

Pin Number	Pin Name	Functional Description
1, 2, 4, 5, 8, 18 to 26, 28, 29, 45	A0 to A16	Address Input pins
33 to 35, 38 to 42	I/O1 to I/O8	Data Input/Output pins
44	CE1	Chip Enable 1 Input pin
7	CE2	Chip Enable 2 Input pin
6	WE	Write Enable Input pin
48	ŌĒ	Output Enable Input pin
10, 16, 37	VDD	Supply Voltage pins Connect all three pins to the power supply.
13, 27, 46	VSS	Ground pins Connect all three pins to ground.
3, 9, 11, 12, 14, 15, 17, 30 to 32, 36, 43, 47	NC	No Connect pins

## **■ BLOCK DIAGRAM**



### **■ FUNCTIONAL TRUTH TABLE**

Operation Mode	CE1	CE2	WE	OE	I/O1 to I/O8	<b>Supply Current</b>	
	Н	Х	Х	Х		01	
Standby Precharge	Х	L	Х	Х	Hi-Z	Standby (IsB)	
	Х	Х	Н	Н		(100)	
Read	7	Н	Н	L			
neau	L	<u></u>		_	Data Output		
Read_ (Pseudo-SRAM, OE control*1)	L	Н	Н	Z		Operation	
Write	7_	Н	L	Н		(Icc)	
VVIIIC	L	工		11	Data Input		
Write (Pseudo-SRAM, WE control*2)	L	Н	Z	Н			

Note:  $L = V_{IL}$ ,  $H = V_{IH}$ , X can be either  $V_{IL}$  or  $V_{IH}$ , Hi-Z = High Impedance  $\supseteq$ : 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: WE control of the Pseudo-SRAM means the valid address and data at the falling edge of WE to write.

#### ■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rat	Unit	
Parameter		Min	Max	Offic
Power Supply Voltage*	Vcc	- 0.5	+ 4.0	V
Input Pin Voltage*	Vin	- 0.5	$V_{CC} + 0.5 \ (\le 4.0)$	V
Output Pin Voltage*	<b>V</b> out	- 0.5	$V_{CC} + 0.5 \ (\le 4.0)$	V
Operating Temperature	TA	<b>- 40</b>	+ 85	°C
Storage Temperature	Тѕтс	- 40	+ 125	°C

<sup>\* :</sup> All voltages are referenced to VSS = 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	Cymhol	Value				
Parameter	Symbol	Min	Тур	Max	Unit	
Power Supply Voltage*	Vcc	3.0	3.3	3.6	V	
High Level Input Voltage*	VIH	Vcc × 0.8	_	$Vcc + 0.5 ( \le 4.0)$	V	
Low Level Input Voltage*	VıL	- 0.5	_	+ 0.6	٧	
Operating Temperature	TA	- 40	_	+ 85	°C	

<sup>\*:</sup> All voltages are referenced to VSS = 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	Condition		Value		Unit
raiailletei	Syllibol	Condition	Min	Тур	Max	Ollit
Input Leakage Current	Iu	Vin = 0 V to Vcc			10	μΑ
Output Leakage Current	ILO	$V_{OUT} = 0 \text{ V to } V_{CC},$ $\overline{CE}1 = V_{IH} \text{ or } \overline{OE} = V_{IH}$			10	μΑ
Operating Power Supply Current	Icc	$\overline{\text{CE}}$ 1 = 0.2 V, CE2 = Vcc-0.2 V, I <sub>out</sub> = 0 mA* <sup>1</sup>	_	10	15	mA
Standby Current	Isa	$\label{eq:center} \begin{split} \overline{CE} 1 & \geq V_{\text{CC}} - 0.2 \text{ V} \\ CE2 & \leq 0.2 \text{ V}^{*2} \\ \overline{OE} & \geq V_{\text{CC}} - 0.2 \text{ V}, \ \overline{WE} \geq V_{\text{CC}} - 0.2 \text{ V}^{*2} \end{split}$	_	10	50	μΑ
High Level Output Voltage	Vон	Iон = −1.0 mA	Vcc × 0.8	_	_	V
Low Level Output Voltage	Vol	IoL = 2.0 mA	_	_	0.4	V

<sup>\*1 :</sup> During the measurement of Icc, the Address, Data In were taken to only change once per active cycle. Iout: output current

<sup>\*2 :</sup> 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. AC Characteristics

#### • AC Test Conditions

Supply Voltage : 3.0 V to 3.6 VOperating Temperature  $: -40 \,^{\circ}\text{C} \text{ to } +85 \,^{\circ}\text{C}$ 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 Cycle

(within recommended operating conditions)

Parameter	Symbol	Va	lue	Unit
Farameter	Cymbol	Min	Max	Unit
Read Cycle Time	tnc	150	_	ns
CE1 Active Time	t <sub>CA1</sub>	120		ns
CE2 Active Time	tca2	120		ns
OE Active Time	t <sub>RP</sub>	120	_	ns
Precharge Time	<b>t</b> PC	20	_	ns
Address Setup Time	tas	0	_	ns
Address Hold Time	tан	50	_	ns
OE Setup Time	tes	0	_	ns
Output Hold Time	tон	0	_	ns
Output Set Time	<b>t</b> Lz	30	_	ns
CE1 Access Time	t <sub>CE1</sub>	_	100	ns
CE2 Access Time	tcE2	_	100	ns
OE Access Time	toe	_	100	ns
Output Floating Time	tонz		20	ns

## (2) Write Cycle

(within recommended operating conditions)

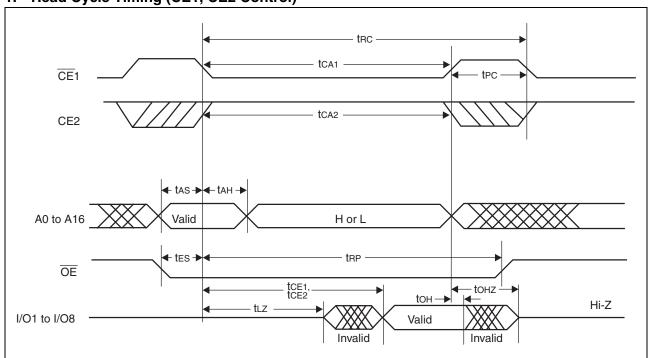
Parameter	Symbol	Va	lue	Unit
Farameter	- Cymbol	Min	Max	Oilit
Write Cycle Time	twc	150	_	ns
CE1 Active Time	t <sub>CA1</sub>	120	_	ns
CE2 Active Time	t <sub>CA2</sub>	120	_	ns
Precharge Time	<b>t</b> PC	20	_	ns
Address Setup Time	<b>t</b> as	0	_	ns
Address Hold Time	<b>t</b> ah	50	_	ns
Write Pulse Width	twp	120	_	ns
Data Setup Time	<b>t</b> os	0	_	ns
Data Hold Time	tон	50	_	ns
Write Setup Time	tws	0	_	ns

# 3. Pin Capacitance

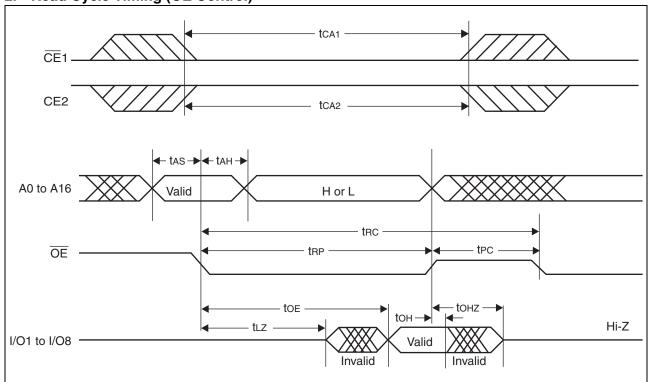
Parameter	Symbol	bol Condition Value				Unit
Faranietei	Зушьог	Condition	Min	Тур	Max	Oille
Input Capacitance	Cin	$V_{IN} = V_{OUT} = 0 V$ ,	_	_	10	pF
Output Capacitance	Соит	f = 1 MHz, T <sub>A</sub> = +25 °C		_	10	pF

## **■ TIMING DIAGRAMS**

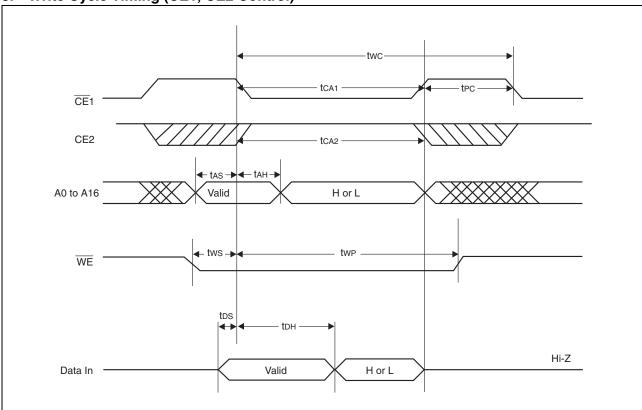
## 1. Read Cycle Timing (CE1, CE2 Control)



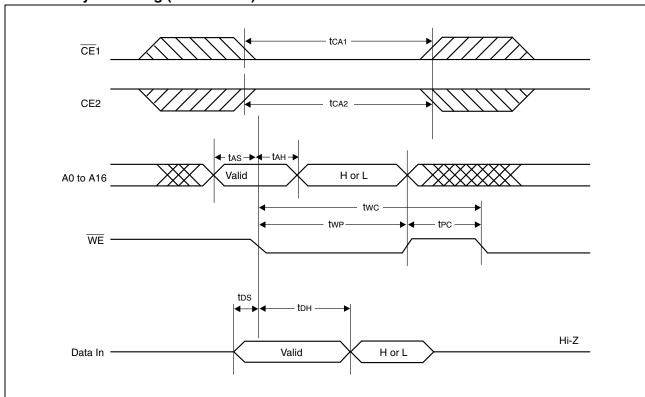
## 2. Read Cycle Timing (OE Control)



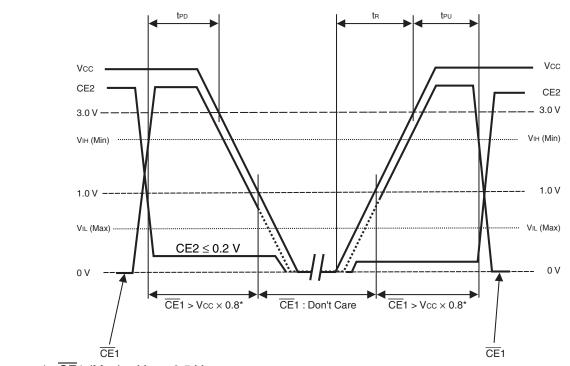
## 3. Write Cycle Timing (CE1, CE2 Control)



# 4. Write Cycle Timing (WE Control)



### **■ POWER ON/OFF SEQUENCE**



\* : <del>CE</del>1 (Max) < Vcc + 0.5 V

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

- Because turning the power-on from an intermediate level cause malfunction, when the power is turned on, Vcc 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.
- When turning the power on or off, it is recommended that CE2 is connected to ground to prevent unexpected writing.

(within recommended operating conditions)

Dovometer	Cumbal		I I m i i		
Parameter	Symbol	Min	Тур	Max	Unit
CE1 level hold time for Power OFF	<b>t</b> PD	85	_		ns
CE1 level hold time for Power ON	<b>t</b> PU	85	_	_	ns
Power supply rising time	t⊓	0.05	_	200	ms

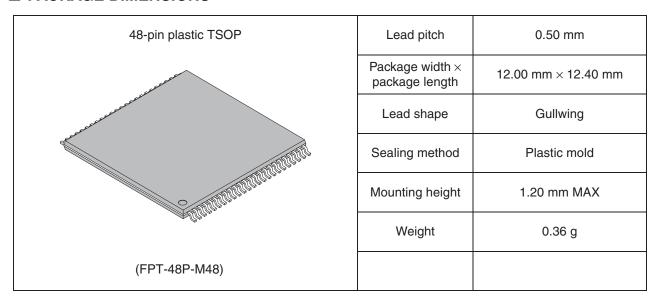
#### **■ NOTES ON USE**

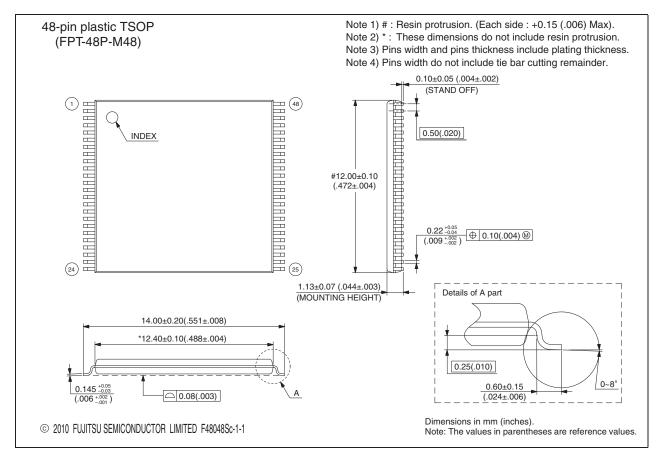
After the IR reflow completed, it is not guaranteed to hold the data written prior to the IR reflow.

## ■ ORDERING INFOMATION

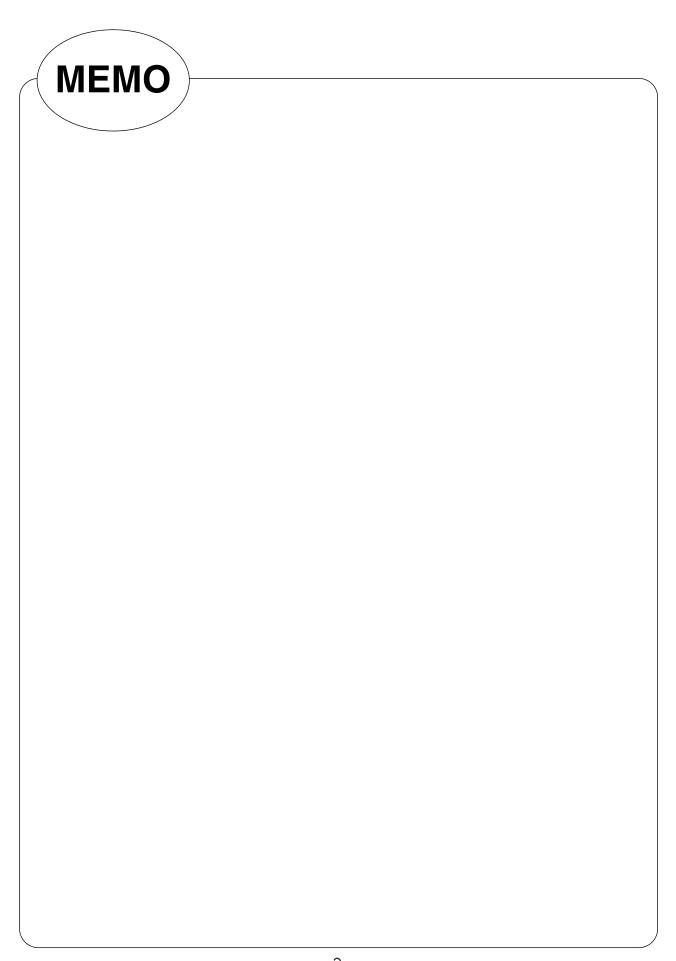
Part Number	Package
MB85R1001ANC-GE1	48-pin plastic TSOP(1) (FPT-48P-M48)

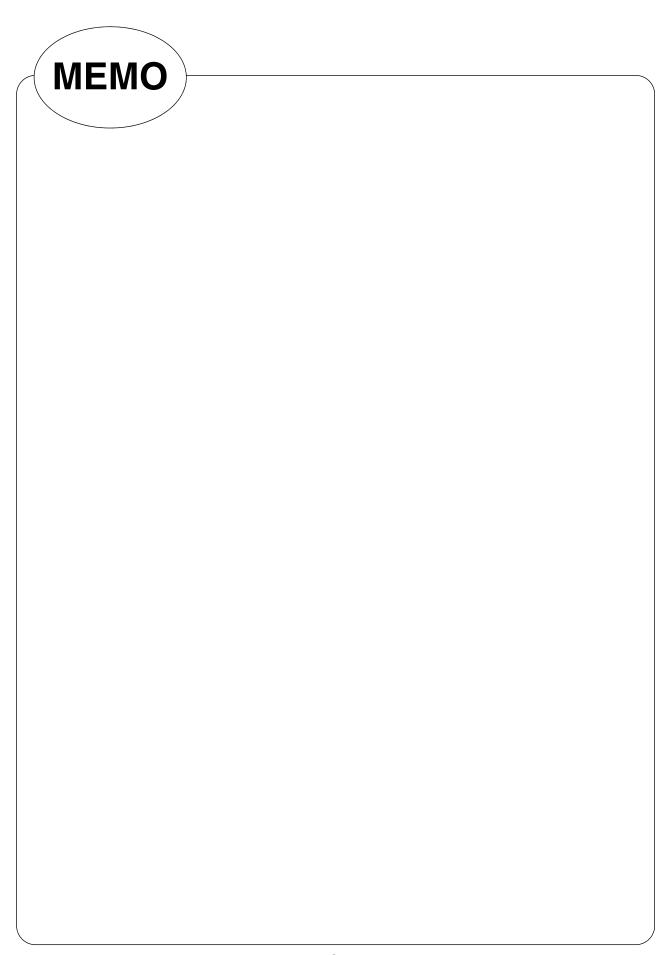
#### **■ PACKAGE DIMENSIONS**

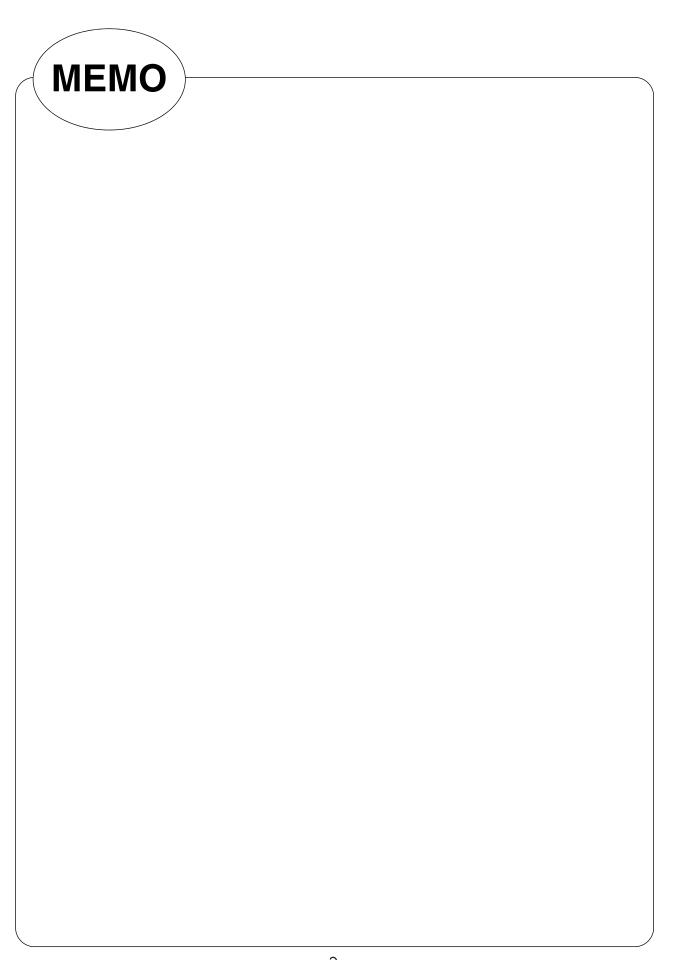




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# **FUJITSU SEMICONDUCTOR LIMITED**

Nomura Fudosan Shin-yokohama Bldg. 10-23, Shin-yokohama 2-Chome, Kohoku-ku Yokohama Kanagawa 222-0033, Japan

Tel: +81-45-415-5858 http://jp.fujitsu.com/fsl/en/

For further information please contact:

#### North and South America

FUJITSU SEMICONDUCTOR 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://us.fujitsu.com/micro/

#### Europe

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

#### Korea

FUJITSU SEMICONDUCTOR KOREA LTD. 902 Kosmo Tower Building, 1002 Daechi-Dong, Gangnam-Gu, Seoul 135-280, Republic of Korea Tel: +82-2-3484-7111 http://kr.fujitsu.com/fsk/

#### **Asia Pacific**

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

FUJITSU SEMICONDUCTOR 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/fss/

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