FUJITSU SEMICONDUCTOR
DATA SHEET

DS07–12627–6E

8-bit Microcontrollers

CMOS

F²MC-8FX MB95260H/270H/280H Series

MB95F262H/F262K/F263H/F263K/F264H/F264K
MB95F272H/F272K/F273H/F273K/F274H/F274K
MB95F282H/F282K/F283H/F283K/F284H/F284K

■ DESCRIPTION

MB95260H/270H/280H are series of general-purpose, single-chip microcontrollers. In addition to a compact instruction set, the microcontrollers of these series contain a variety of peripheral resources.

Note: F²MC is the abbreviation of FUJITSU Flexible Microcontroller.

■ FEATURES

- F²MC-8FX CPU core
  Instruction set optimized for controllers
  - Multiplication and division instructions
  - 16-bit arithmetic operations
  - Bit test branch instructions
  - Bit manipulation instructions, etc.
- Clock (main OSC clock and sub-OSC clock are only available in MB95F262H/F262K/F263H/F263K/F264H/F264K/F282H/F282K/F283H/F283K/F284H/F284K)
  - Selectable main clock source
    Main OSC clock (up to 16.25 MHz, maximum machine clock frequency: 8.125 MHz)
    External clock (up to 32.5 MHz, maximum machine clock frequency: 16.25 MHz)
    Main CR clock (1/8/10 MHz ±3%, maximum machine clock frequency: 10 MHz)
  - Selectable subclock source
    Sub-OSC clock (32.768 kHz)
    External clock (32.768 kHz)
    Sub CR clock (Typ: 100 kHz, Min: 50 kHz, Max: 200 kHz)
- Timer
  - 8/16-bit composite timer
  - Timebase timer
  - Watch prescaler
- LIN-UART (MB95F262H/F262K/F263H/F263K/F264H/F264K/F282H/F282K/F283H/F283K/F284H/F284K)
  - Full duplex double buffer
  - Capable of clock-synchronized serial data transfer and clock-asynchronized serial data transfer

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- External interrupt
  - Interrupt by edge detection (rising edge, falling edge, and both edges can be selected)
  - Can be used to wake up the device from different low power consumption (standby) modes
- 8/10-bit A/D converter
  - 8-bit or 10-bit resolution can be selected.
- Low power consumption (standby) modes
  - Stop mode
  - Sleep mode
  - Watch mode
  - Timebase timer mode
- I/O port (Max: 17) (MB95F262K/F263K/F264K)
  - General-purpose I/O ports (Max):
    CMOS I/O: 15, N-ch open drain: 2
- I/O port (Max: 16) (MB95F262H/F263H/F264H)
  - General-purpose I/O ports (Max):
    CMOS I/O: 15, N-ch open drain: 1
- I/O port (Max: 5) (MB95F272K/F273K/F274K)
  - General-purpose I/O ports (Max):
    CMOS I/O: 3, N-ch open drain: 2
- I/O port (Max: 4) (MB95F272H/F273H/F274H)
  - General-purpose I/O ports (Max):
    CMOS I/O: 3, N-ch open drain: 1
- I/O port (Max: 13) (MB95F282K/F283K/F284K)
  - General-purpose I/O ports (Max):
    CMOS I/O: 11, N-ch open drain: 2
- I/O port (Max: 12) (MB95F282H/F283H/F284H)
  - General-purpose I/O ports (Max):
    CMOS I/O: 11, N-ch open drain: 1
- On-chip debug
  - 1-wire serial control
  - Serial writing supported (asynchronous mode)
- Hardware/software watchdog timer
  - Built-in hardware watchdog timer
- Low-voltage detection reset circuit
  - Built-in low-voltage detector
- Clock supervisor counter
  - Built-in clock supervisor counter function
- Programmable port input voltage level
  - CMOS input level / hysteresis input level
- Dual operation Flash memory
  - The erase/write operation and the read operation can be executed in different banks (upper bank/lower bank) simultaneously.
- Flash memory security function
  - Protects the content of the Flash memory

■ PRODUCT LINE-UP

- MB95260H Series

Part number / Parameter	MB95F262H	MB95F263H	MB95F264H	MB95F262K	MB95F263K	MB95F264K
Type	Flash memory product					
Clock supervisor counter	It supervises the main clock oscillation.					
Program ROM capacity	8 Kbytes	12 Kbytes	20 Kbytes	8 Kbytes	12 Kbytes	20 Kbytes
RAM capacity	240 bytes	496 bytes	496 bytes	240 bytes	496 bytes	496 bytes
Low-voltage detection reset	No			Yes		
Reset input	Dedicated			Selected by software		
CPU functions	Number of basic instructions : 136 Instruction bit length : 8 bits Instruction length : 1 to 3 bytes Data bit length : 1, 8 and 16 bits Minimum instruction execution time : 61.5 ns (with machine clock = 16.25 MHz) Interrupt processing time : 0.6 µs (with machine clock = 16.25 MHz)					
General-purpose I/O	I/O ports (Max): 16 CMOS I/O: 15 N-ch open drain: 1			I/O ports (Max): 17 CMOS I/O: 15 N-ch open drain: 2		
Timebase timer	Interrupt cycle : 0.256 ms to 8.3 s (when external clock = 4 MHz)					
Hardware/ software watchdog timer	Reset generation cycle Main oscillation clock at 10 MHz: 105 ms (Min) The sub CR clock can be used as the source clock of the hardware watchdog timer.					
Wild register	It can be used to replace three bytes of data.					
LIN-UART	A wide range of communication speed can be selected by a dedicated reload timer. It has a full duplex double buffer. Clock-synchronized serial data transfer and clock-asynchronized serial data transfer is enabled. The LIN function can be used as a LIN master or a LIN slave.					
8/10-bit A/D converter	6 channels					
	8-bit or 10-bit resolution can be selected.					
8/16-bit composite timer	2 channels					
	The timer can be configured as an "8-bit timer × 2 channels" or a "16-bit timer × 1 channel". It has built-in timer function, PWC function, PWM function and input capture function. Count clock: it can be selected from internal clocks (seven types) and external clocks. It can output square wave.					
External interrupt	6 channels					
	Interrupt by edge detection (The rising edge, falling edge, or both edges can be selected.) It can be used to wake up the device from the standby mode.					
On-chip debug	1-wire serial control It supports serial writing. (asynchronous mode)					

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Parameter \ Part number	MB95F262H	MB95F263H	MB95F264H	MB95F262K	MB95F263K	MB95F264K
Watch prescaler	Eight different time intervals can be selected.					
Flash memory	It supports automatic programming, Embedded Algorithm, write/erase/erase-suspend/erase-resume commands. It has a flag indicating the completion of the operation of Embedded Algorithm. Number of write/erase cycles: 100000 Data retention time: 20 years Flash security feature for protecting the content of the Flash memory					
Standby mode	Sleep mode, stop mode, watch mode, timebase timer mode					
Package	DIP-24P-M07 LCC-32P-M19 FPT-20P-M09 FPT-20P-M10					

- MB95270H Series

Parameter \ Part number	MB95F272H	MB95F273H	MB95F274H	MB95F272K	MB95F273K	MB95F274K
Type	Flash memory product					
Clock supervisor counter	It supervises the main clock oscillation.					
Program ROM capacity	8 Kbytes	12 Kbytes	20 Kbytes	8 Kbytes	12 Kbytes	20 Kbytes
RAM capacity	240 bytes	496 bytes	496 bytes	240 bytes	496 bytes	496 bytes
Low-voltage detection reset	No			Yes		
Reset input	Dedicated			Selected by software		
CPU functions	Number of basic instructions : 136 Instruction bit length : 8 bits Instruction length : 1 to 3 bytes Data bit length : 1, 8 and 16 bits Minimum instruction execution time : 61.5 ns (with machine clock = 16.25 MHz) Interrupt processing time : 0.6 µs (with machine clock = 16.25 MHz)					
General-purpose I/O	I/O ports (Max): 4 CMOS I/O: 3 N-ch open drain: 1			I/O ports (Max): 5 CMOS I/O: 3 N-ch open drain: 2		
Timebase timer	Interrupt cycle : 0.256 ms to 8.3 s (when external clock = 4 MHz)					
Hardware/ software watchdog timer	Reset generation cycle Main oscillation clock at 10 MHz: 105 ms (Min) The sub-internal CR clock can be used as the source clock of the hardware watchdog timer.					
Wild register	It can be used to replace three bytes of data.					
LIN-UART	No LIN-UART					
8/10-bit A/D converter	2 channels					
	8-bit or 10-bit resolution can be selected.					
8/16-bit composite timer	1 channel					
	The timer can be configured as an "8-bit timer × 2 channels" or a "16-bit timer × 1 channel". It has built-in timer function, PWC function, PWM function and input capture function. Count clock: it can be selected from internal clocks (seven types) and external clocks. It can output square wave.					
External interrupt	2 channels					
	Interrupt by edge detection (The rising edge, falling edge, or both edges can be selected.) It can be used to wake up the device from standby modes.					
On-chip debug	1-wire serial control It supports serial writing. (asynchronous mode)					
Watch prescaler	Eight different time intervals can be selected.					
Flash memory	It supports automatic programming, Embedded Algorithm, write/erase/erase-suspend/erase-resume commands. It has a flag indicating the completion of the operation of Embedded Algorithm. Number of write/erase cycles : 100000 Data retention time: 20 years Flash security feature for protecting the content of the Flash memory					
Standby mode	Sleep mode, stop mode, watch mode, timebase timer mode					
Package	DIP-8P-M03 FPT-8P-M08					

- MB95280H Series

Parameter \ Part number	MB95F282H	MB95F283H	MB95F284H	MB95F282K	MB95F283K	MB95F284K
Type	Flash memory product					
Clock supervisor counter	It supervises the main clock oscillation.					
Program ROM capacity	8 Kbytes	12 Kbytes	20 Kbytes	8 Kbytes	12 Kbytes	20 Kbytes
RAM capacity	240 bytes	496 bytes	496 bytes	240 bytes	496 bytes	496 bytes
Low-voltage detection reset	No			Yes		
Reset input	Dedicated			Selected by software		
CPU functions	Number of basic instructions : 136 Instruction bit length : 8 bits Instruction length : 1 to 3 bytes Data bit length : 1, 8 and 16 bits Minimum instruction execution time : 61.5 ns (with machine clock = 16.25 MHz) Interrupt processing time : 0.6 µs (with machine clock = 16.25 MHz)					
General-purpose I/O	I/O ports (Max): 12 CMOS I/O: 11 N-ch open drain: 1			I/O ports (Max): 13 CMOS I/O: 11 N-ch open drain: 2		
Timebase timer	Interrupt cycle : 0.256 ms to 8.3 s (when external clock = 4 MHz)					
Hardware/ software watchdog timer	Reset generation cycle Main oscillation clock at 10 MHz: 105 ms (Min) The sub-internal CR clock can be used as the source clock of the hardware watchdog timer.					
Wild register	It can be used to replace three bytes of data.					
LIN-UART	A wide range of communication speed can be selected by a dedicated reload timer. It has a full duplex double buffer. Clock-synchronized serial data transfer and clock-asynchronized serial data transfer is enabled. The LIN function can be used as a LIN master or a LIN slave.					
8/10-bit A/D converter	5 channels					
	8-bit or 10-bit resolution can be selected.					
8/16-bit composite timer	1 channel					
	The timer can be configured as an "8-bit timer × 2 channels" or a "16-bit timer × 1 channel". It has built-in timer function, PWC function, PWM function and input capture function. Count clock: it can be selected from internal clocks (seven types) and external clocks. It can output square wave.					
External interrupt	6 channels					
	Interrupt by edge detection (The rising edge, falling edge, or both edges can be selected.) It can be used to wake up the device from standby modes.					
On-chip debug	1-wire serial control It supports serial writing. (asynchronous mode)					

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Part number / Parameter	MB95F282H	MB95F283H	MB95F284H	MB95F282K	MB95F283K	MB95F284K
Watch prescaler	Eight different time intervals can be selected.					
Flash memory	It supports automatic programming, Embedded Algorithm, write/erase/erase-suspend/erase-resume commands. It has a flag indicating the completion of the operation of Embedded Algorithm. Number of write/erase cycles : 100000 Data retention time: 20 years Flash security feature for protecting the content of the Flash memory					
Standby mode	Sleep mode, stop mode, watch mode, timebase timer mode					
Package	LCC-32P-M19 DIP-16P-M06 FPT-16P-M06					

■ PACKAGES AND CORRESPONDING PRODUCTS

Part number / Package	MB95F 262H	MB95F 262K	MB95F 263H	MB95F 263K	MB95F 264H	MB95F 264K	MB95F 272H	MB95F 272K	MB95F 273H	MB95F 273K	MB95F 274H	MB95F 274K
DIP-24P-M07	O	O	O	O	O	O	X	X	X	X	X	X
FPT-20P-M09	O	O	O	O	O	O	X	X	X	X	X	X
FPT-20P-M10	O	O	O	O	O	O	X	X	X	X	X	X
DIP-16P-M06	X	X	X	X	X	X	X	X	X	X	X	X
FPT-16P-M06	X	X	X	X	X	X	X	X	X	X	X	X
DIP-8P-M03	X	X	X	X	X	X	O	O	O	O	O	O
FPT-8P-M08	X	X	X	X	X	X	O	O	O	O	O	O
LCC-32P-M19	O	O	O	O	O	O	X	X	X	X	X	X

Part number / Package	MB95F 282H	MB95F 282K	MB95F 283H	MB95F 283K	MB95F 284H	MB95F 284K
DIP-24P-M07	X	X	X	X	X	X
FPT-20P-M09	X	X	X	X	X	X
FPT-20P-M10	X	X	X	X	X	X
DIP-16P-M06	O	O	O	O	O	O
FPT-16P-M06	O	O	O	O	O	O
DIP-8P-M03	X	X	X	X	X	X
FPT-8P-M08	X	X	X	X	X	X
LCC-32P-M19	O	O	O	O	O	O

O: Available
X: Unavailable

■ DIFFERENCES AMONG PRODUCTS AND NOTES ON PRODUCT SELECTION

• Current consumption

When using the on-chip debug function, take account of the current consumption of flash erase/write.

For details of current consumption, see "■ ELECTRICAL CHARACTERISTICS".

• Package

For details of information on each package, see "■ PACKAGES AND CORRESPONDING PRODUCTS" and "■ PACKAGE DIMENSIONS".

• Operating voltage

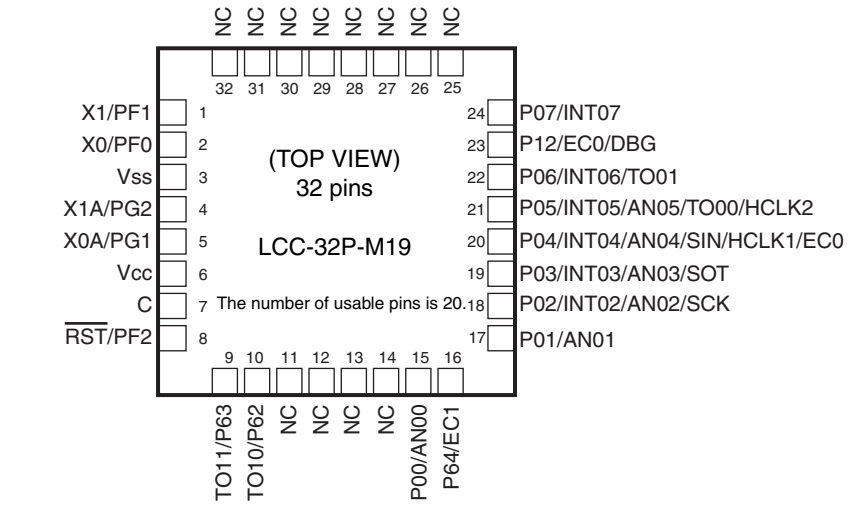
The operating voltage varies, depending on whether the on-chip debug function is used or not.

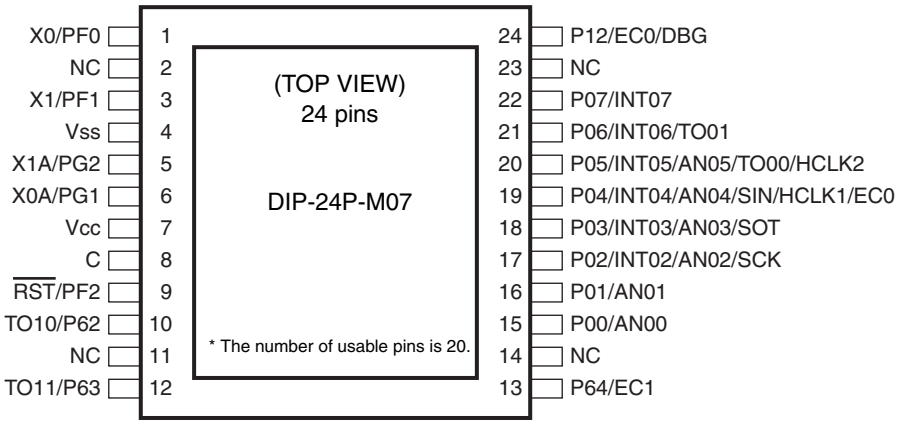
For details of the operating voltage, see "■ ELECTRICAL CHARACTERISTICS".

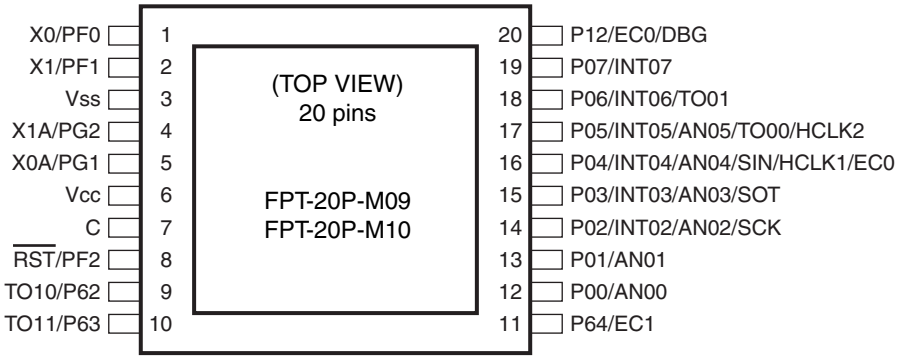
• On-chip debug function

The on-chip debug function requires that V_{CC}, V_{SS} and 1 serial-wire be connected to an evaluation tool. In addition, if the Flash memory data has to be updated, the $\overline{RST}$/PF2 pin must also be connected to the same evaluation tool.

■ PIN ASSIGNMENT







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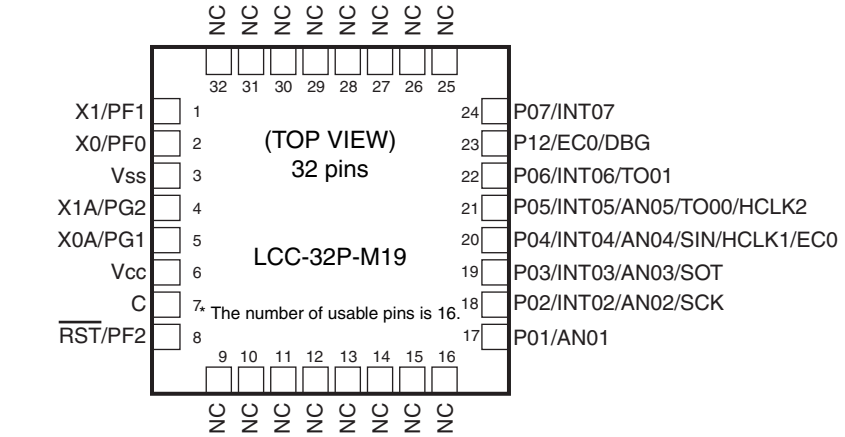
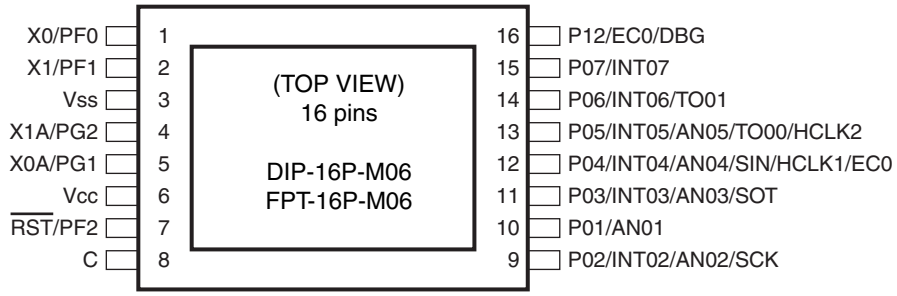
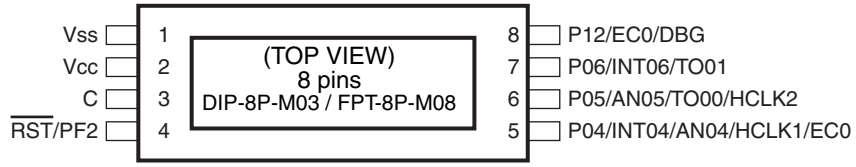

NC NC NC NC NC NC NC NC
32 31 30 29 28 27 26 25
X1/PF1 1
X0/PF0 2
Vss 3
X1A/PG2 4
X0A/PG1 5
Vcc 6
C 7
RST/PF2 8
(TOP VIEW)
32 pins
LCD-32P-M19
* The number of usable pins is 16.
24 P07/INT07
23 P12/EC0/DBG
22 P06/INT06/TO01
21 P05/INT05/AN05/TO00/HCLK2
20 P04/INT04/AN04/SIN/HCLK1/EC0
19 P03/INT03/AN03/SOT
18 P02/INT02/AN02/SCK
17 P01/AN01
9 10 11 12 13 14 15 16
NC NC NC NC NC NC NC NC


X0/PF0 1
X1/PF1 2
Vss 3
X1A/PG2 4
X0A/PG1 5
Vcc 6
RST/PF2 7
C 8
(TOP VIEW)
16 pins
DIP-16P-M06
FPT-16P-M06
16 P12/EC0/DBG
15 P07/INT07
14 P06/INT06/TO01
13 P05/INT05/AN05/TO00/HCLK2
12 P04/INT04/AN04/SIN/HCLK1/EC0
11 P03/INT03/AN03/SOT
10 P01/AN01
9 P02/INT02/AN02/SCK


Vss 1
Vcc 2
C 3
RST/PF2 4
(TOP VIEW)
8 pins
DIP-8P-M03 / FPT-8P-M08
8 P12/EC0/DBG
7 P06/INT06/TO01
6 P05/AN05/TO00/HCLK2
5 P04/INT04/AN04/HCLK1/EC0

■ PIN DESCRIPTION (MB95260H Series, 32 pins)

Pin no.	Pin name	I/O circuit type*	Function
1	PF1	B	General-purpose I/O port
	X1		Main clock I/O oscillation pin
2	PF0	B	General-purpose I/O port
	X0		Main clock input oscillation pin
3	Vss	—	Power supply pin (GND)
4	PG2	C	General-purpose I/O port
	X1A		Subclock I/O oscillation pin
5	PG1	C	General-purpose I/O port
	X0A		Subclock input oscillation pin
6	Vcc	—	Power supply pin
7	C	—	Capacitor connection pin
8	PF2	A	General-purpose I/O port
	$\overline{RST}$		Reset pin This is a dedicated reset pin in MB95F262H/F263H/F264H.
9	P63	D	General-purpose I/O port High-current pin
	TO11		8/16-bit composite timer ch. 1 output pin
10	P62	D	General-purpose I/O port High-current pin
	TO10		8/16-bit composite timer ch. 1 output pin
11	NC	—	It is an internally connected pin. Always leave it unconnected.
12	NC	—	It is an internally connected pin. Always leave it unconnected.
13	NC	—	It is an internally connected pin. Always leave it unconnected.
14	NC	—	It is an internally connected pin. Always leave it unconnected.
15	P00	E	General-purpose I/O port
	AN00		A/D converter analog input pin
16	P64	D	General-purpose I/O port
	EC1		8/16-bit composite timer ch. 1 clock input pin
17	P01	E	General-purpose I/O port
	AN01		A/D converter analog input pin
18	P02	E	General-purpose I/O port
	INT02		External interrupt input pin
	AN02		A/D converter analog input pin
	SCK		LIN-UART clock I/O pin
19	P03	E	General-purpose I/O port
	INT03		External interrupt input pin
	AN03		A/D converter analog input pin
	SOT		LIN-UART data output pin

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Pin no.	Pin name	I/O circuit type*	Function
20	P04	F	General-purpose I/O port
	INT04		External interrupt input pin
	AN04		A/D converter analog input pin
	SIN		LIN-UART data input pin
	HCLK1		External clock input pin
	EC0		8/16-bit composite timer ch. 0 clock input pin
21	P05	E	General-purpose I/O port High-current pin
	INT05		External interrupt input pin
	AN05		A/D converter analog input pin
	TO00		8/16-bit composite timer ch. 0 output pin
	HCLK2		External clock input pin
22	P06	G	General-purpose I/O port High-current pin
	INT06		External interrupt input pin
	TO01		8/16-bit composite timer ch. 0 output pin
23	P12	H	General-purpose I/O port
	EC0		8/16-bit composite timer ch. 0 clock input pin
	DBG		DBG input pin
24	P07	G	General-purpose I/O port
	INT07		External interrupt input pin
25	NC	—	It is an internally connected pin. Always leave it unconnected.
26	NC	—	It is an internally connected pin. Always leave it unconnected.
27	NC	—	It is an internally connected pin. Always leave it unconnected.
28	NC	—	It is an internally connected pin. Always leave it unconnected.
29	NC	—	It is an internally connected pin. Always leave it unconnected.
30	NC	—	It is an internally connected pin. Always leave it unconnected.
31	NC	—	It is an internally connected pin. Always leave it unconnected.
32	NC	—	It is an internally connected pin. Always leave it unconnected.

*: For the I/O circuit types, see “■ I/O CIRCUIT TYPE”.

■ PIN DESCRIPTION (MB95260H Series, 24 pins)

Pin no.	Pin name	I/O circuit type*	Function
1	PF0	B	General-purpose I/O port
	X0		Main clock input oscillation pin
2	NC	—	It is an internally connected pin. Always leave it unconnected.
3	PF1	B	General-purpose I/O port
	X1		Main clock I/O oscillation pin
4	V_{SS}	—	Power supply pin (GND)
5	PG2	C	General-purpose I/O port
	X1A		Subclock I/O oscillation pin
6	PG1	C	General-purpose I/O port
	X0A		Subclock input oscillation pin
7	V_{CC}	—	Power supply pin
8	C	—	Capacitor connection pin
9	PF2	A	General-purpose I/O port
	$\overline{RST}$		Reset pin This is a dedicated reset pin in MB95F262H/F263H/F264H.
10	P62	D	General-purpose I/O port High-current pin
	TO10		8/16-bit composite timer ch. 1 output pin
11	NC	—	It is an internally connected pin. Always leave it unconnected.
12	P63	D	General-purpose I/O port High-current pin
	TO11		8/16-bit composite timer ch. 1 output pin
13	P64	D	General-purpose I/O port
	EC1		8/16-bit composite timer ch. 1 clock input pin
14	NC	—	It is an internally connected pin. Always leave it unconnected.
15	P00	E	General-purpose I/O port
	AN00		A/D converter analog input pin
16	P01	E	General-purpose I/O port
	AN01		A/D converter analog input pin
17	P02	E	General-purpose I/O port
	INT02		External interrupt input pin
	AN02		A/D converter analog input pin
	SCK		LIN-UART clock I/O pin

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Pin no.	Pin name	I/O circuit type*	Function
18	P03	E	General-purpose I/O port
	INT03		External interrupt input pin
	AN03		A/D converter analog input pin
	SOT		LIN-UART data output pin
19	P04	F	General-purpose I/O port
	INT04		External interrupt input pin
	AN04		A/D converter analog input pin
	SIN		LIN-UART data input pin
	HCLK1		External clock input pin
	EC0		8/16-bit composite timer ch. 0 clock input pin
20	P05	E	General-purpose I/O port High-current pin
	INT05		External interrupt input pin
	AN05		A/D converter analog input pin
	TO00		8/16-bit composite timer ch. 0 output pin
	HCLK2		External clock input pin
21	P06	G	General-purpose I/O port High-current pin
	INT06		External interrupt input pin
	TO01		8/16-bit composite timer ch. 0 output pin
22	P07	G	General-purpose I/O port
	INT07		External interrupt input pin
23	NC	—	It is an internally connected pin. Always leave it unconnected.
24	P12	H	General-purpose I/O port
	EC0		8/16-bit composite timer ch. 0 clock input pin
	DBG		DBG input pin

*: For the I/O circuit types, see “■ I/O CIRCUIT TYPE”.

■ PIN DESCRIPTION (MB95260H Series, 20 pins)

Pin no.	Pin name	I/O circuit type*	Function
1	PF0	B	General-purpose I/O port
	X0		Main clock input oscillation pin
2	PF1	B	General-purpose I/O port
	X1		Main clock I/O oscillation pin
3	V_{SS}	—	Power supply pin (GND)
4	PG2	C	General-purpose I/O port
	X1A		Subclock I/O oscillation pin
5	PG1	C	General-purpose I/O port
	X0A		Subclock input oscillation pin
6	V_{CC}	—	Power supply pin
7	C	—	Capacitor connection pin
8	PF2	A	General-purpose I/O port
	$\overline{RST}$		Reset pin This is a dedicated reset pin in MB95F262H/F263H/F264H.
9	P62	D	General-purpose I/O port High-current pin
	TO10		8/16-bit composite timer ch. 1 output pin
10	P63	D	General-purpose I/O port High-current pin
	TO11		8/16-bit composite timer ch. 1 output pin
11	P64	D	General-purpose I/O port
	EC1		8/16-bit composite timer ch. 1 clock input pin
12	P00	E	General-purpose I/O port
	AN00		A/D converter analog input pin
13	P01	E	General-purpose I/O port
	AN01		A/D converter analog input pin
14	P02	E	General-purpose I/O port
	INT02		External interrupt input pin
	AN02		A/D converter analog input pin
	SCK		LIN-UART clock I/O pin
15	P03	E	General-purpose I/O port
	INT03		External interrupt input pin
	AN03		A/D converter analog input pin
	SOT		LIN-UART data output pin

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Pin no.	Pin name	I/O circuit type*	Function
16	P04	F	General-purpose I/O port
	INT04		External interrupt input pin
	AN04		A/D converter analog input pin
	SIN		LIN-UART data input pin
	HCLK1		External clock input pin
	EC0		8/16-bit composite timer ch. 0 clock input pin
17	P05	E	General-purpose I/O port High-current pin
	INT05		External interrupt input pin
	AN05		A/D converter analog input pin
	TO00		8/16-bit composite timer ch. 0 output pin
	HCLK2		External clock input pin
18	P06	G	General-purpose I/O port High-current pin
	INT06		External interrupt input pin
	TO01		8/16-bit composite timer ch. 0 output pin
19	P07	G	General-purpose I/O port
	INT07		External interrupt input pin
20	P12	H	General-purpose I/O port
	EC0		8/16-bit composite timer ch. 0 clock input pin
	DBG		DBG input pin

*: For the I/O circuit types, see “■ I/O CIRCUIT TYPE”.

■ PIN DESCRIPTION (MB95270H Series, 8 pins)

Pin no.	Pin name	I/O circuit type*	Function
1	V_{SS}	—	Power supply pin (GND)
2	V_{CC}	—	Power supply pin
3	C	—	Capacitor connection pin
4	PF2	A	General-purpose I/O port
	$\overline{RST}$		Reset pin This pin is a dedicated reset pin in MB95F272H/F273H/F274H.
5	P04	F	General-purpose I/O port
	INT04		External interrupt input pin
	AN04		A/D converter analog input pin
	HCLK1		External clock input pin
	EC0		8/16-bit composite timer ch. 0 clock input pin
6	P05	E	General-purpose I/O port High-current pin
	AN05		A/D converter analog input pin
	TO00		8/16-bit composite timer ch. 0 output pin
	HCLK2		External clock input pin
7	P06	G	General-purpose I/O port High-current pin
	INT06		External interrupt input pin
	TO01		8/16-bit composite timer ch. 0 output pin
8	P12	H	General-purpose I/O port
	EC0		8/16-bit composite timer ch. 0 clock input pin
	DBG		DBG input pin

*: For the I/O circuit types, see “■ I/O CIRCUIT TYPE”.

■ PIN DESCRIPTION (MB95280H Series, 32 pins)

Pin no.	Pin name	I/O circuit type*	Function
1	PF1	B	General-purpose I/O port
	X1		Main clock I/O oscillation pin
2	PF0	B	General-purpose I/O port
	X0		Main clock input oscillation pin
3	Vss	—	Power supply pin (GND)
4	PG2	C	General-purpose I/O port
	X1A		Subclock I/O oscillation pin
5	PG1	C	General-purpose I/O port
	X0A		Subclock input oscillation pin
6	Vcc	—	Power supply pin
7	C	—	Capacitor connection pin
8	PF2	A	General-purpose I/O port
	$\overline{\text{RST}}$		Reset pin This is a dedicated reset pin in MB95F282H/F283H/F284H.
9	NC	—	It is an internally connected pin. Always leave it unconnected.
10	NC	—	It is an internally connected pin. Always leave it unconnected.
11	NC	—	It is an internally connected pin. Always leave it unconnected.
12	NC	—	It is an internally connected pin. Always leave it unconnected.
13	NC	—	It is an internally connected pin. Always leave it unconnected.
14	NC	—	It is an internally connected pin. Always leave it unconnected.
15	NC	—	It is an internally connected pin. Always leave it unconnected.
16	NC	—	It is an internally connected pin. Always leave it unconnected.
17	P01	E	General-purpose I/O port
	AN01		A/D converter analog input pin
18	P02	E	General-purpose I/O port
	INT02		External interrupt input pin
	AN02		A/D converter analog input pin
	SCK		LIN-UART clock I/O pin
19	P03	E	General-purpose I/O port
	INT03		External interrupt input pin
	AN03		A/D converter analog input pin
	SOT		LIN-UART data output pin
20	P04	F	General-purpose I/O port
	INT04		External interrupt input pin
	AN04		A/D converter analog input pin
	SIN		LIN-UART data input pin
	HCLK1		External clock input pin
	EC0		8/16-bit composite timer ch. 0 clock input pin

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Pin no.	Pin name	I/O circuit type*	Function
21	P05	E	General-purpose I/O port High-current pin
	INT05		External interrupt input pin
	AN05		A/D converter analog input pin
	TO00		8/16-bit composite timer ch. 0 output pin
	HCLK2		External clock input pin
22	P06	G	General-purpose I/O port High-current pin
	INT06		External interrupt input pin
	TO01		8/16-bit composite timer ch. 0 output pin
23	P12	H	General-purpose I/O port
	EC0		8/16-bit composite timer ch. 0 clock input pin
	DBG		DBG input pin
24	P07	G	General-purpose I/O port
	INT07		External interrupt input pin
25	NC	—	It is an internally connected pin. Always leave it unconnected.
26	NC	—	It is an internally connected pin. Always leave it unconnected.
27	NC	—	It is an internally connected pin. Always leave it unconnected.
28	NC	—	It is an internally connected pin. Always leave it unconnected.
29	NC	—	It is an internally connected pin. Always leave it unconnected.
30	NC	—	It is an internally connected pin. Always leave it unconnected.
31	NC	—	It is an internally connected pin. Always leave it unconnected.
32	NC	—	It is an internally connected pin. Always leave it unconnected.

*: For the I/O circuit types, see “■ I/O CIRCUIT TYPE”.

■ PIN DESCRIPTION (MB95280H Series, 16 pins)

Pin no.	Pin name	I/O circuit type*	Function
1	PF0	B	General-purpose I/O port
	X0		Main clock input oscillation pin
2	PF1	B	General-purpose I/O port
	X1		Main clock I/O oscillation pin
3	V_{SS}	—	Power supply pin (GND)
4	PG2	C	General-purpose I/O port
	X1A		Subclock I/O oscillation pin
5	PG1	C	General-purpose I/O port
	X0A		Subclock input oscillation pin
6	V_{CC}	—	Power supply pin
7	PF2	A	General-purpose I/O port
	$\overline{RST}$		Reset pin This pin is a dedicated reset pin in MB95F282H/F283H/F284H.
8	C	—	Capacitor connection pin
9	P02	E	General-purpose I/O port
	INT02		External interrupt input pin
	AN02		A/D converter analog input pin
	SCK		LIN-UART clock I/O pin
10	P01	E	General-purpose I/O port
	AN01		A/D converter analog input pin
11	P03	E	General-purpose I/O port
	INT03		External interrupt input pin
	AN03		A/D converter analog input pin
	SOT		LIN-UART data output pin
12	P04	F	General-purpose I/O port
	INT04		External interrupt input pin
	AN04		A/D converter analog input pin
	SIN		LIN-UART data input pin
	HCLK1		External clock input pin
	EC0		8/16-bit composite timer ch. 0 clock input pin

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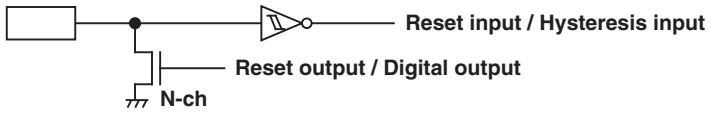
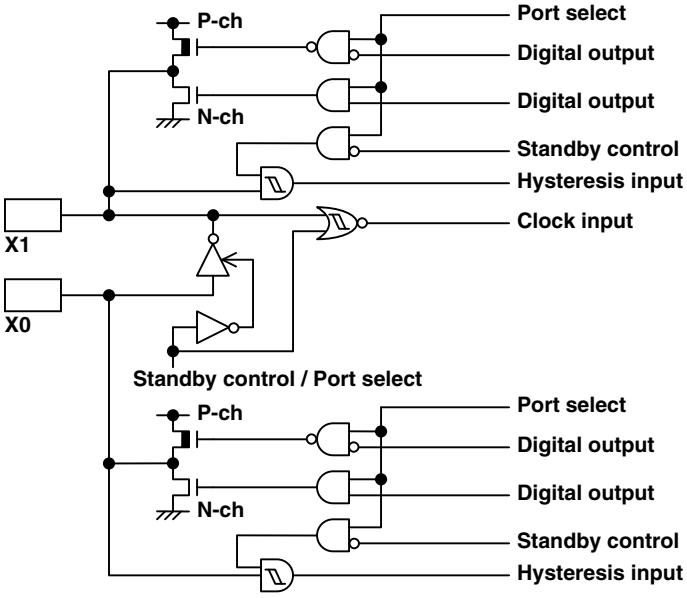
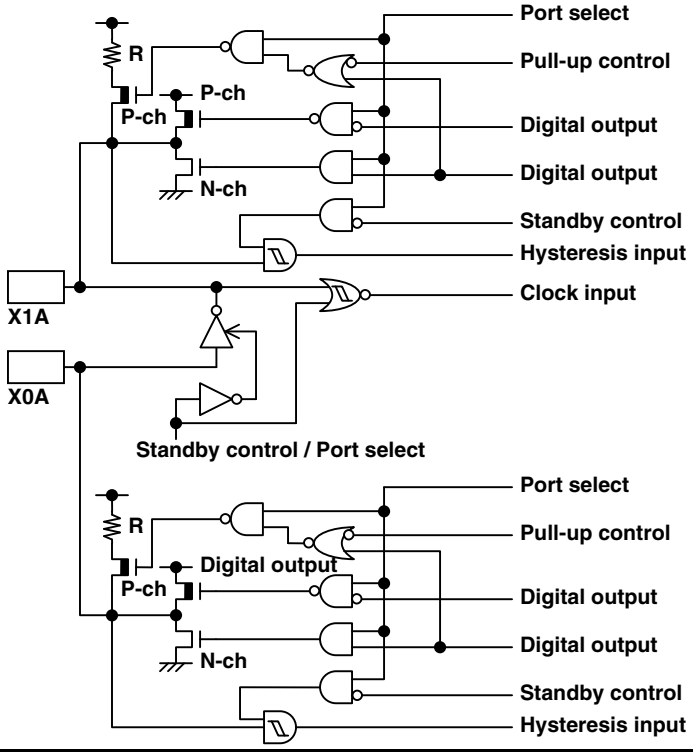
Pin no.	Pin name	I/O circuit type*	Function
13	P05	E	General-purpose I/O port High-current pin
	INT05		External interrupt input pin
	AN05		A/D converter analog input pin
	TO00		8/16-bit composite timer ch. 0 clock input pin
	HCLK2		External clock input pin
14	P06	G	General-purpose I/O port High-current pin
	INT06		External interrupt input pin
	TO01		8/16-bit composite timer ch. 0 clock input pin
15	P07	G	General-purpose I/O port
	INT07		External interrupt input pin
16	P12	H	General-purpose I/O port
	EC0		8/16-bit composite timer ch. 0 clock input pin
	DBG		DBG input pin

*: For the I/O circuit types, see “■ I/O CIRCUIT TYPE”.

■ I/O CIRCUIT TYPE

Type	Circuit	Remarks
A		• N-ch open drain output • Hysteresis input • Reset output
B		• Oscillation circuit • High-speed side • Feedback resistance: approx. 1 MΩ • CMOS output • Hysteresis input
C		• Oscillation circuit • Low-speed side • Feedback resistance: approx.10 MΩ • CMOS output • Hysteresis input • Pull-up control available

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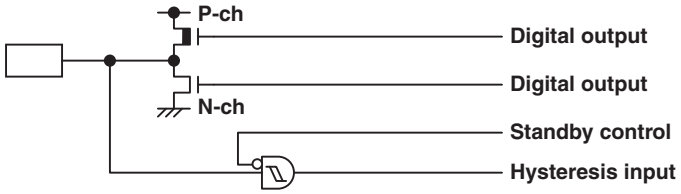
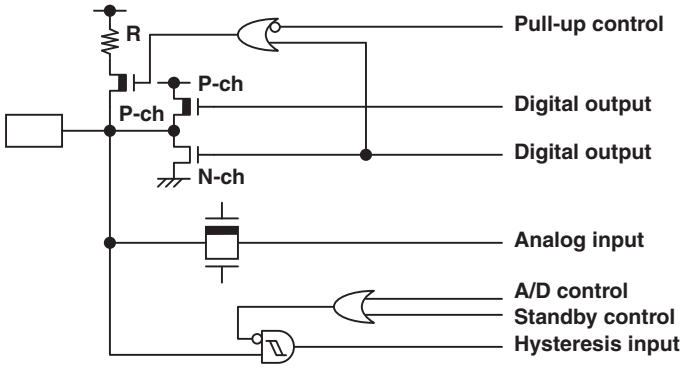
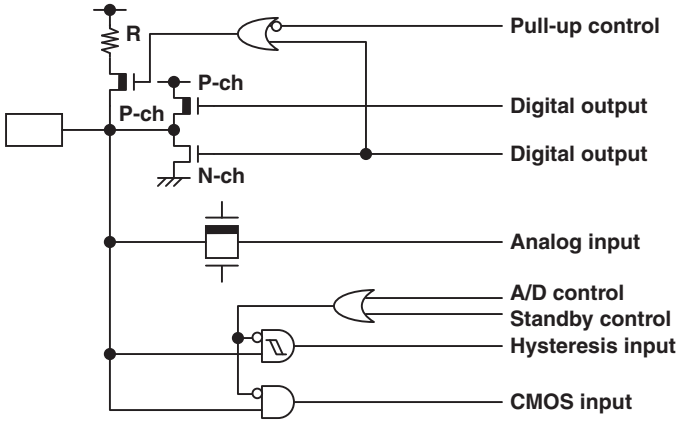
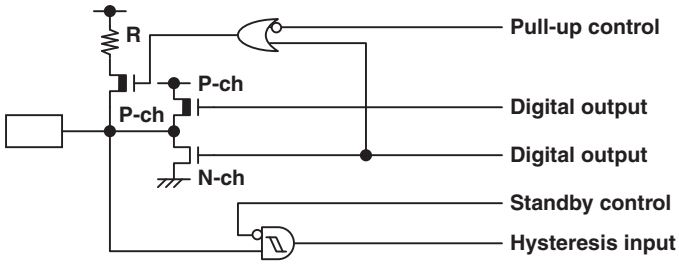
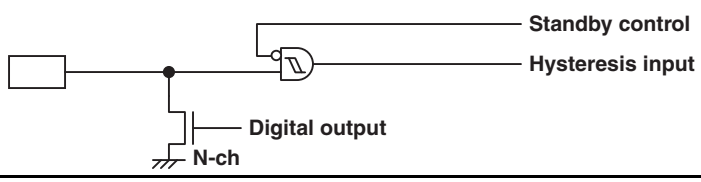
Type	Circuit	Remarks
D		• CMOS output • Hysteresis input
E		• CMOS output • Hysteresis input • Pull-up control available
F		• CMOS output • Hysteresis input • CMOS input • Pull-up control available
G		• Hysteresis input • CMOS output • Pull-up control available
H		• N-ch open drain output • Hysteresis input

■ NOTES ON DEVICE HANDLING

• Preventing latch-ups

When using the device, ensure that the voltage applied does not exceed the maximum voltage rating.
In a CMOS IC, if a voltage higher than V_{CC} or a voltage lower than V_{SS} is applied to an input/output pin that is neither a medium-withstand voltage pin nor a high-withstand voltage pin, or if a voltage out of the rating range of power supply voltage mentioned in "1. Absolute Maximum Ratings" of “ ■ ELECTRICAL CHARACTERISTICS” is applied to the V_{CC} pin or the V_{SS} pin, a latch-up may occur.
When a latch-up occurs, power supply current increases significantly, which may cause a component to be thermally destroyed.

• Stabilizing supply voltage

Supply voltage must be stabilized.
A malfunction may occur when power supply voltage fluctuates rapidly even though the fluctuation is within the guaranteed operating range of the V_{CC} power supply voltage.
As a rule of voltage stabilization, suppress voltage fluctuation so that the fluctuation in V_{CC} ripple (p-p value) at the commercial frequency (50 Hz/60 Hz) does not exceed 10% of the standard V_{CC} value, and the transient fluctuation rate does not exceed 0.1 V/ms at a momentary fluctuation such as switching the power supply.

• Notes on using the external clock

When an external clock is used, oscillation stabilization wait time is required for power-on reset, wake-up from subclock mode or stop mode.

■ PIN CONNECTION

• Treatment of unused pins

If an unused input pin is left unconnected, a component may be permanently damaged due to malfunctions or latch-ups. Always pull up or pull down an unused input pin through a resistor of at least 2 kΩ. Set an unused input/output pin to the output state and leave it unconnected, or set it to the input state and treat it the same as an unused input pin. If there is an unused output pin, leave it unconnected.

• Power supply pins

To reduce unnecessary electro-magnetic emission, prevent malfunctions of strobe signals due to an increase in the ground level, and conform to the total output current standard, always connect the V_{CC} pin and the V_{SS} pin to the power supply and ground outside the device. In addition, connect the current supply source to the V_{CC} pin and the V_{SS} pin with low impedance.
It is also advisable to connect a ceramic capacitor of approximately 0.1 µF as a bypass capacitor between the V_{CC} pin and the V_{SS} pin at a location close to this device.

• DBG pin

Connect the DBG pin directly to an external pull-up resistor.
To prevent the device from unintentionally entering the debug mode due to noise, minimize the distance between the DBG pin and the V_{CC} or V_{SS} pin when designing the layout of the printed circuit board.
The DBG pin should not stay at “L” level after power-on until the reset output is released.

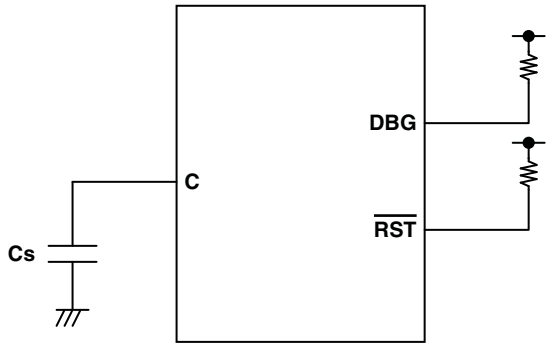
• $\overline{\text{RST}}$ pin

Connect the $\overline{\text{RST}}$ pin directly to an external pull-up resistor.
To prevent the device from unintentionally entering the reset mode due to noise, minimize the distance between the $\overline{\text{RST}}$ pin and the V_{CC} or V_{SS} pin when designing the layout of the printed circuit board.
The $\overline{\text{RST}}$/PF2 pin functions as the reset input/output pin after power-on. In addition, the reset output of the $\overline{\text{RST}}$/PF2 pin can be enabled by the RSTOE bit of the SYSC register, and the reset input function and the general purpose I/O function can be selected by the RSTEN bit of the SYSC register.

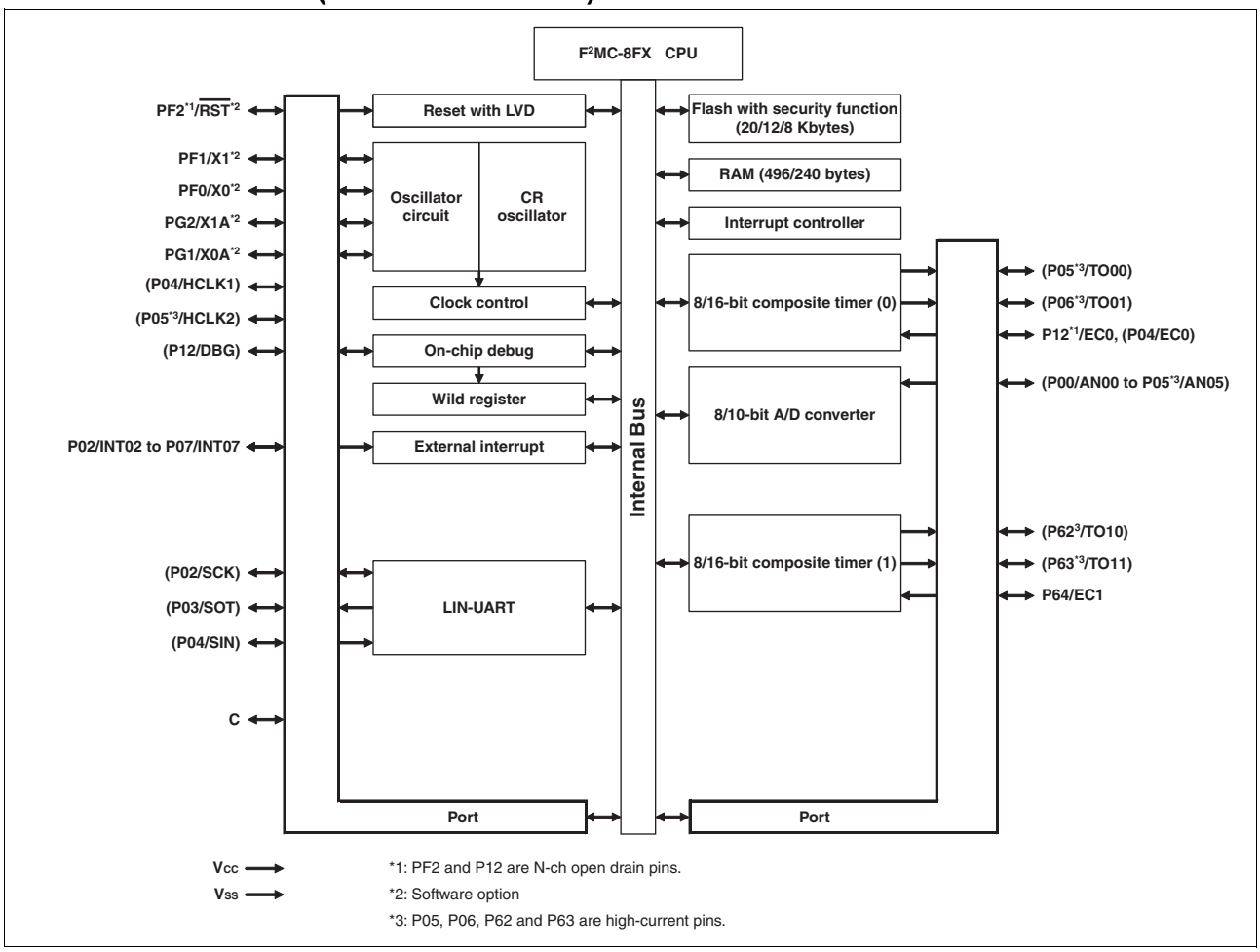
• C pin

Use a ceramic capacitor or a capacitor with equivalent frequency characteristics. The bypass capacitor for the V_{CC} pin must have a capacitance larger than C_S. For the connection to a smoothing capacitor C_S, see the diagram below. To prevent the device from unintentionally entering a mode to which the device is not set to transit due to noise, minimize the distance between the C pin and C_S and the distance between C_S and the V_{SS} pin when designing the layout of a printed circuit board.

• DBG/$\overline{\text{RST}}$/C pins connection diagram

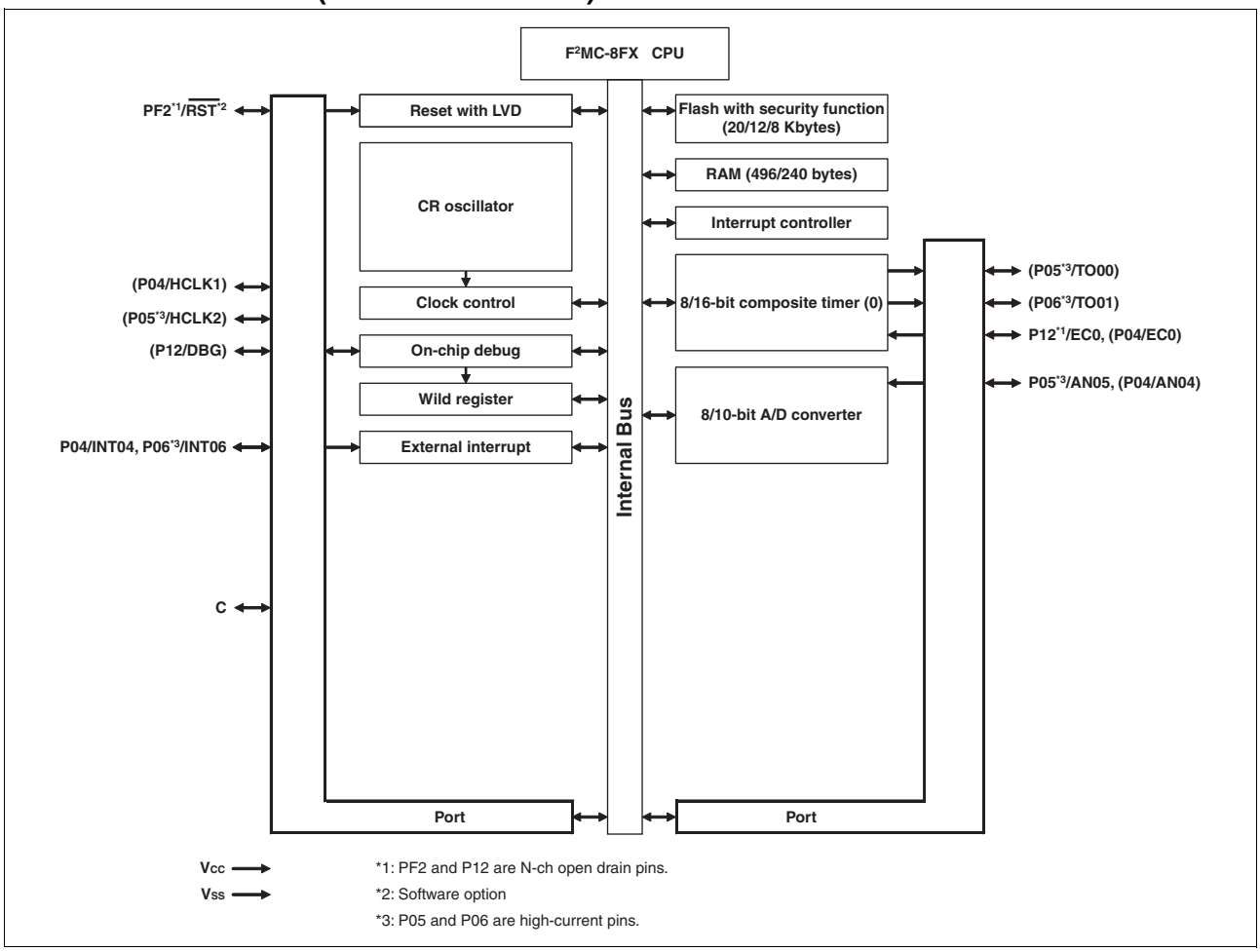


■ BLOCK DIAGRAM (MB95260H Series)

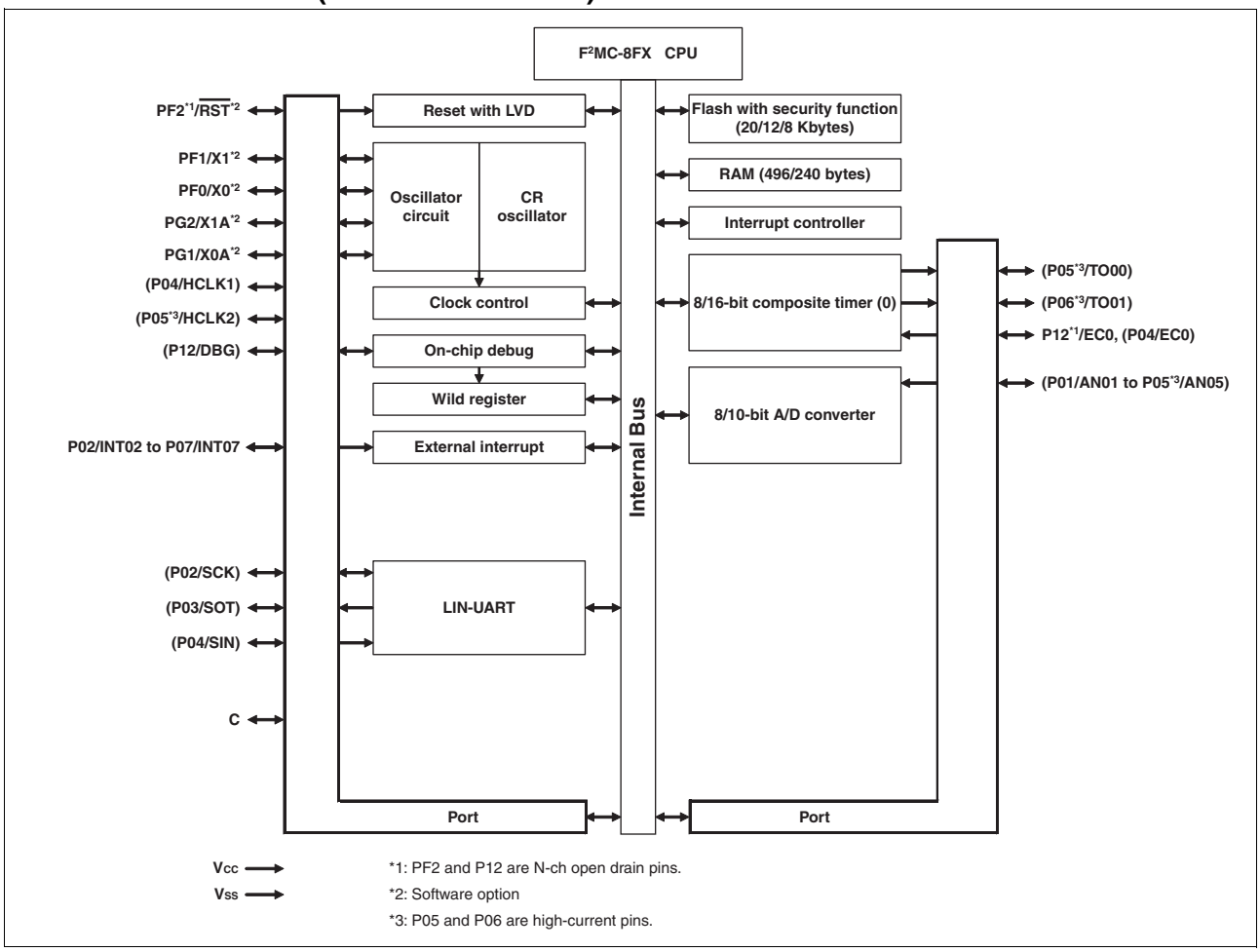


*1: PF2 and P12 are N-ch open drain pins.
*2: Software option
*3: P05, P06, P62 and P63 are high-current pins.

■ BLOCK DIAGRAM (MB95270H Series)



■ BLOCK DIAGRAM (MB95280H Series)

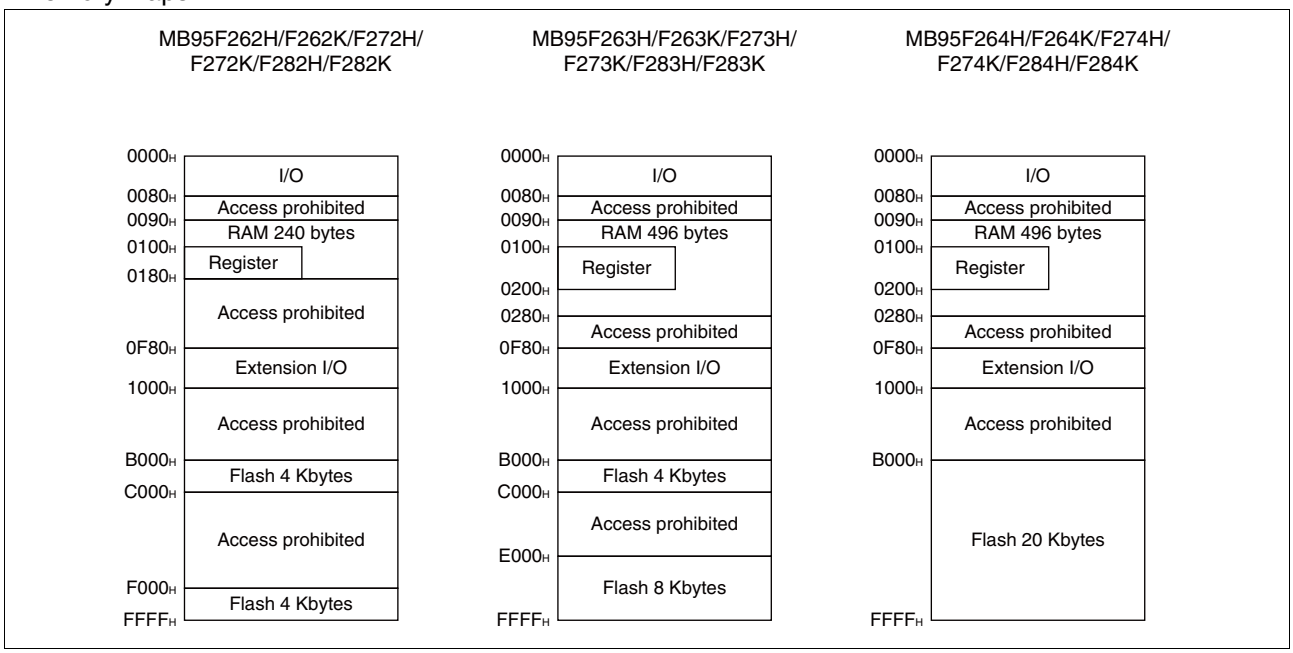


■ CPU CORE

• Memory Space

The memory space of the MB95260H/270H/280H Series is 64 Kbytes in size, and consists of an I/O area, a data area, and a program area. The memory space includes areas intended for specific purposes such as general-purpose registers and a vector table. The memory maps of the MB95260H/270H/280H Series are shown below.

• Memory Maps



■ I/O MAP (MB95260H Series)

Address	Register abbreviation	Register name	R/W	Initial value
0000H	PDR0	Port 0 data register	R/W	00000000B
0001H	DDR0	Port 0 direction register	R/W	00000000B
0002H	PDR1	Port 1 data register	R/W	00000000B
0003H	DDR1	Port 1 direction register	R/W	00000000B
0004H	—	(Disabled)	—	—
0005H	WATR	Oscillation stabilization wait time setting register	R/W	11111111B
0006H	—	(Disabled)	—	—
0007H	SYCC	System clock control register	R/W	0000X011B
0008H	STBC	Standby control register	R/W	00000XXXB
0009H	RSRR	Reset source register	R	XXXXXXXXB
000AH	TBTC	Timebase timer control register	R/W	00000000B
000BH	WPCR	Watch prescaler control register	R/W	00000000B
000CH	WDTC	Watchdog timer control register	R/W	00XX0000B
000DH	SYCC2	System clock control register 2	R/W	XX100011B
000EH to 0015H	—	(Disabled)	—	—
0016H	PDR6	Port 6 data register	R/W	00000000B
0017H	DDR6	Port 6 direction register	R/W	00000000B
0018H to 0027H	—	(Disabled)	—	—
0028H	PDRF	Port F data register	R/W	00000000B
0029H	DDRF	Port F direction register	R/W	00000000B
002AH	PDRG	Port G data register	R/W	00000000B
002BH	DDRG	Port G direction register	R/W	00000000B
002CH	PUL0	Port 0 pull-up register	R/W	00000000B
002DH to 0034H	—	(Disabled)	—	—
0035H	PULG	Port G pull-up register	R/W	00000000B
0036H	T01CR1	8/16-bit composite timer 01 status control register 1 ch. 0	R/W	00000000B
0037H	T00CR1	8/16-bit composite timer 00 status control register 1 ch. 0	R/W	00000000B
0038H	T11CR1	8/16-bit composite timer 11 status control register 1 ch. 1	R/W	00000000B
0039H	T10CR1	8/16-bit composite timer 10 status control register 1 ch. 1	R/W	00000000B
003AH to 0048H	—	(Disabled)	—	—
0049H	EIC10	External interrupt circuit control register ch. 2/ch. 3	R/W	00000000B

(Continued)

Address	Register abbreviation	Register name	R/W	Initial value
004A$_H$	EIC20	External interrupt circuit control register ch. 4/ch. 5	R/W	00000000$_B$
004B$_H$	EIC30	External interrupt circuit control register ch. 6/ch. 7	R/W	00000000$_B$
004C$_H$ to 004F$_H$	—	(Disabled)	—	—
0050$_H$	SCR	LIN-UART serial control register	R/W	00000000$_B$
0051$_H$	SMR	LIN-UART serial mode register	R/W	00000000$_B$
0052$_H$	SSR	LIN-UART serial status register	R/W	00001000$_B$
0053$_H$	RDR/TDR	LIN-UART receive/transmit data register	R/W	00000000$_B$
0054$_H$	ESCR	LIN-UART extended status control register	R/W	00000100$_B$
0055$_H$	ECCR	LIN-UART extended communication control register	R/W	000000XX$_B$
0056$_H$ to 006B$_H$	—	(Disabled)	—	—
006C$_H$	ADC1	8/10-bit A/D converter control register 1	R/W	00000000$_B$
006D$_H$	ADC2	8/10-bit A/D converter control register 2	R/W	00000000$_B$
006E$_H$	ADDH	8/10-bit A/D converter data register (Upper)	R/W	00000000$_B$
006F$_H$	ADDL	8/10-bit A/D converter data register (Lower)	R/W	00000000$_B$
0070$_H$	—	(Disabled)	—	—
0071$_H$	FSR2	Flash memory status register 2	R/W	00000000$_B$
0072$_H$	FSR	Flash memory status register	R/W	000X0000$_B$
0073$_H$	SWRE0	Flash memory sector write control register 0	R/W	00000000$_B$
0074$_H$	FSR3	Flash memory status register 3	R	0000XXXX$_B$
0075$_H$	—	(Disabled)	—	—
0076$_H$	WREN	Wild register address compare enable register	R/W	00000000$_B$
0077$_H$	WROR	Wild register data test setting register	R/W	00000000$_B$
0078$_H$	—	Mirror of register bank pointer (RP) and direct bank pointer (DP)	—	—
0079$_H$	ILR0	Interrupt level setting register 0	R/W	11111111$_B$
007A$_H$	ILR1	Interrupt level setting register 1	R/W	11111111$_B$
007B$_H$	ILR2	Interrupt level setting register 2	R/W	11111111$_B$
007C$_H$	ILR3	Interrupt level setting register 3	R/W	11111111$_B$
007D$_H$	ILR4	Interrupt level setting register 4	R/W	11111111$_B$
007E$_H$	ILR5	Interrupt level setting register 5	R/W	11111111$_B$
007F$_H$	—	(Disabled)	—	—
0F80$_H$	WRARH0	Wild register address setting register (Upper) ch. 0	R/W	00000000$_B$

(Continued)

Address	Register abbreviation	Register name	R/W	Initial value
0F81H	WRARL0	Wild register address setting register (Lower) ch. 0	R/W	00000000B
0F82H	WRDR0	Wild register data setting register ch. 0	R/W	00000000B
0F83H	WRARH1	Wild register address setting register (Upper) ch. 1	R/W	00000000B
0F84H	WRARL1	Wild register address setting register (Lower) ch. 1	R/W	00000000B
0F85H	WRDR1	Wild register data setting register ch. 1	R/W	00000000B
0F86H	WRARH2	Wild register address setting register (Upper) ch. 2	R/W	00000000B
0F87H	WRARL2	Wild register address setting register (Lower) ch. 2	R/W	00000000B
0F88H	WRDR2	Wild register data setting register ch. 2	R/W	00000000B
0F89H to 0F91H	—	(Disabled)	—	—
0F92H	T01CR0	8/16-bit composite timer 01 status control register 0 ch. 0	R/W	00000000B
0F93H	T00CR0	8/16-bit composite timer 00 status control register 0 ch. 0	R/W	00000000B
0F94H	T01DR	8/16-bit composite timer 01 data register ch. 0	R/W	00000000B
0F95H	T00DR	8/16-bit composite timer 00 data register ch. 0	R/W	00000000B
0F96H	TMCR0	8/16-bit composite timer 00/01 timer mode control register ch. 0	R/W	00000000B
0F97H	T11CR0	8/16-bit composite timer 11 status control register 0 ch. 1	R/W	00000000B
0F98H	T10CR0	8/16-bit composite timer 10 status control register 0 ch. 1	R/W	00000000B
0F99H	T11DR	8/16-bit composite timer 11 data register ch. 1	R/W	00000000B
0F9AH	T10DR	8/16-bit composite timer 10 data register ch. 1	R/W	00000000B
0F9BH	TMCR1	8/16-bit composite timer 10/11 timer mode control register ch. 1	R/W	00000000B
0F9CH to 0FBBH	—	(Disabled)	—	—
0FBCH	BGR1	LIN-UART baud rate generator register 1	R/W	00000000B
0FBDH	BGR0	LIN-UART baud rate generator register 0	R/W	00000000B
0FBEH to 0FC2H	—	(Disabled)	—	—
0FC3H	AIDRL	A/D input disable register (Lower)	R/W	00000000B
0FC4H to 0FE3H	—	(Disabled)	—	—
0FE4H	CRTH	Main CR clock trimming register (Upper)	R/W	1XXXXXXXB
0FE5H	CRTL	Main CR clock trimming register (Lower)	R/W	000XXXXXB

(Continued)

(Continued)

Address	Register abbreviation	Register name	R/W	Initial value
0FE6H, 0FE7H	—	(Disabled)	—	—
0FE8H	SYSC	System configuration register	R/W	11000011B
0FE9H	CMCR	Clock monitoring control register	R/W	00000000B
0FEAH	CMDR	Clock monitoring data register	R/W	00000000B
0FEBH	WDTH	Watchdog timer selection ID register (Upper)	R/W	XXXXXXXXB
0FECH	WDTL	Watchdog timer selection ID register (Lower)	R/W	XXXXXXXXB
0FEDH	—	(Disabled)	—	—
0FEEH	ILSR	Input level select register	R/W	00000000B
0FEFH to 0FFFH	—	(Disabled)	—	—

• R/W access symbols
  R/W : Readable / Writable
  R : Read only

• Initial value symbols
  0 : The initial value of this bit is “0”.
  1 : The initial value of this bit is “1”.
  X : The initial value of this bit is undefined.

Note: Do not write to an address that is “(Disabled)”. If a “(Disabled)” address is read, an indeterminate value is returned.

■ I/O MAP (MB95270H Series)

Address	Register abbreviation	Register name	R/W	Initial value
0000H	PDR0	Port 0 data register	R/W	00000000B
0001H	DDR0	Port 0 direction register	R/W	00000000B
0002H	PDR1	Port 1 data register	R/W	00000000B
0003H	DDR1	Port 1 direction register	R/W	00000000B
0004H	—	(Disabled)	—	—
0005H	WATR	Oscillation stabilization wait time setting register	R/W	11111111B
0006H	—	(Disabled)	—	—
0007H	SYCC	System clock control register	R/W	0000X011B
0008H	STBC	Standby control register	R/W	00000XXXB
0009H	RSRR	Reset source register	R	XXXXXXXXB
000AH	TBTC	Timebase timer control register	R/W	00000000B
000BH	WPCR	Watch prescaler control register	R/W	00000000B
000CH	WDTC	Watchdog timer control register	R/W	00XX0000B
000DH	SYCC2	System clock control register 2	R/W	XX100011B
000EH to 0015H	—	(Disabled)	—	—
0016H	—	(Disabled)	—	—
0017H	—	(Disabled)	—	—
0018H to 0027H	—	(Disabled)	—	—
0028H	PDRF	Port F data register	R/W	00000000B
0029H	DDRF	Port F direction register	R/W	00000000B
002AH	—	(Disabled)	—	—
002BH	—	(Disabled)	—	—
002CH	PUL0	Port 0 pull-up register	R/W	00000000B
002DH to 0034H	—	(Disabled)	—	—
0035H	—	(Disabled)	—	—
0036H	T01CR1	8/16-bit composite timer 01 status control register 1 ch. 0	R/W	00000000B
0037H	T00CR1	8/16-bit composite timer 00 status control register 1 ch. 0	R/W	00000000B
0038H	—	(Disabled)	—	—
0039H	—	(Disabled)	—	—
003AH to 0048H	—	(Disabled)	—	—
0049H	—	(Disabled)	—	—

(Continued)

Address	Register abbreviation	Register name	R/W	Initial value
004A$_H$	EIC20	External interrupt circuit control register ch. 4	R/W	00000000$_B$
004B$_H$	EIC30	External interrupt circuit control register ch. 6	R/W	00000000$_B$
004C$_H$ to 004F$_H$	—	(Disabled)	—	—
0050$_H$	—	(Disabled)	—	—
0051$_H$	—	(Disabled)	—	—
0052$_H$	—	(Disabled)	—	—
0053$_H$	—	(Disabled)	—	—
0054$_H$	—	(Disabled)	—	—
0055$_H$	—	(Disabled)	—	—
0056$_H$ to 006B$_H$	—	(Disabled)	—	—
006C$_H$	ADC1	8/10-bit A/D converter control register 1	R/W	00000000$_B$
006D$_H$	ADC2	8/10-bit A/D converter control register 2	R/W	00000000$_B$
006E$_H$	ADDH	8/10-bit A/D converter data register (Upper)	R/W	00000000$_B$
006F$_H$	ADDL	8/10-bit A/D converter data register (Lower)	R/W	00000000$_B$
0070$_H$	—	(Disabled)	—	—
0071$_H$	FSR2	Flash memory status register 2	R/W	00000000$_B$
0072$_H$	FSR	Flash memory status register	R/W	000X0000$_B$
0073$_H$	SWRE0	Flash memory sector write control register 0	R/W	00000000$_B$
0074$_H$	FSR3	Flash memory status register 3	R	0000XXXX$_B$
0075$_H$	—	(Disabled)	—	—
0076$_H$	WREN	Wild register address compare enable register	R/W	00000000$_B$
0077$_H$	WROR	Wild register data test setting register	R/W	00000000$_B$
0078$_H$	—	Mirror of register bank pointer (RP) and direct bank pointer (DP)	—	—
0079$_H$	ILR0	Interrupt level setting register 0	R/W	11111111$_B$
007A$_H$	ILR1	Interrupt level setting register 1	R/W	11111111$_B$
007B$_H$	—	(Disabled)	—	—
007C$_H$	—	(Disabled)	—	—
007D$_H$	ILR4	Interrupt level setting register 4	R/W	11111111$_B$
007E$_H$	ILR5	Interrupt level setting register 5	R/W	11111111$_B$
007F$_H$	—	(Disabled)	—	—
0F80$_H$	WRARH0	Wild register address setting register (Upper) ch. 0	R/W	00000000$_B$
0F81$_H$	WRARL0	Wild register address setting register (Lower) ch. 0	R/W	00000000$_B$
0F82$_H$	WRDR0	Wild register data setting register ch. 0	R/W	00000000$_B$

(Continued)

Address	Register abbreviation	Register name	R/W	Initial value
0F83H	WRARH1	Wild register address setting register (Upper) ch. 1	R/W	00000000B
0F84H	WRARL1	Wild register address setting register (Lower) ch. 1	R/W	00000000B
0F85H	WRDR1	Wild register data setting register ch. 1	R/W	00000000B
0F86H	WRARH2	Wild register address setting register (Upper) ch. 2	R/W	00000000B
0F87H	WRARL2	Wild register address setting register (Lower) ch. 2	R/W	00000000B
0F88H	WRDR2	Wild register data setting register ch. 2	R/W	00000000B
0F89H to 0F91H	—	(Disabled)	—	—
0F92H	T01CR0	8/16-bit composite timer 01 status control register 0 ch. 0	R/W	00000000B
0F93H	T00CR0	8/16-bit composite timer 00 status control register 0 ch. 0	R/W	00000000B
0F94H	T01DR	8/16-bit composite timer 01 data register ch. 0	R/W	00000000B
0F95H	T00DR	8/16-bit composite timer 00 data register ch. 0	R/W	00000000B
0F96H	TMCR0	8/16-bit composite timer 00/01 timer mode control register ch. 0	R/W	00000000B
0F97H	—	(Disabled)	—	—
0F98H	—	(Disabled)	—	—
0F99H	—	(Disabled)	—	—
0F9AH	—	(Disabled)	—	—
0F9BH	—	(Disabled)	—	—
0F9CH to 0FBBH	—	(Disabled)	—	—
0FBCH	—	(Disabled)	—	—
0FBDH	—	(Disabled)	—	—
0FBEH to 0FC2H	—	(Disabled)	—	—
0FC3H	AIDRL	A/D input disable register (Lower)	R/W	00000000B
0FC4H to 0FE3H	—	(Disabled)	—	—
0FE4H	CRTH	Main CR clock trimming register (Upper)	R/W	1XXXXXXXB
0FE5H	CRTL	Main CR clock trimming register (Lower)	R/W	000XXXXXB
0FE6H, 0FE7H	—	(Disabled)	—	—
0FE8H	SYSC	System configuration register	R/W	11000011B

(Continued)

(Continued)

Address	Register abbreviation	Register name	R/W	Initial value
0FE9H	CMCR	Clock monitoring control register	R/W	00000000B
0FEAH	CMDR	Clock monitoring data register	R/W	00000000B
0FEBH	WDTH	Watchdog timer selection ID register (Upper)	R/W	XXXXXXXXB
0FECH	WDTL	Watchdog timer selection ID register (Lower)	R/W	XXXXXXXXB
0FEDH	—	(Disabled)	—	—
0FEEH	ILSR	Input level select register	R/W	00000000B
0FEFH to 0FFFH	—	(Disabled)	—	—

• R/W access symbols
  R/W : Readable / Writable
  R : Read only

• Initial value symbols
  0 : The initial value of this bit is “0”.
  1 : The initial value of this bit is “1”.
  X : The initial value of this bit is undefined.

Note: Do not write to an address that is “(Disabled)”. If a “(Disabled)” address is read, an indeterminate value is returned.

■ I/O MAP (MB95280H Series)

Address	Register abbreviation	Register name	R/W	Initial value
0000H	PDR0	Port 0 data register	R/W	00000000B
0001H	DDR0	Port 0 direction register	R/W	00000000B
0002H	PDR1	Port 1 data register	R/W	00000000B
0003H	DDR1	Port 1 direction register	R/W	00000000B
0004H	—	(Disabled)	—	—
0005H	WATR	Oscillation stabilization wait time setting register	R/W	11111111B
0006H	—	(Disabled)	—	—
0007H	SYCC	System clock control register	R/W	0000X011B
0008H	STBC	Standby control register	R/W	00000XXXB
0009H	RSRR	Reset source register	R	XXXXXXXXB
000AH	TBTC	Timebase timer control register	R/W	00000000B
000BH	WPCR	Watch prescaler control register	R/W	00000000B
000CH	WDTC	Watchdog timer control register	R/W	00XX0000B
000DH	SYCC2	System clock control register 2	R/W	XX100011B
000EH to 0015H	—	(Disabled)	—	—
0016H	—	(Disabled)	—	—
0017H	—	(Disabled)	—	—
0018H to 0027H	—	(Disabled)	—	—
0028H	PDRF	Port F data register	R/W	00000000B
0029H	DDRF	Port F direction register	R/W	00000000B
002AH	PDRG	Port G data register	R/W	00000000B
002BH	DDRG	Port G direction register	R/W	00000000B
002CH	PUL0	Port 0 pull-up register	R/W	00000000B
002DH to 0034H	—	(Disabled)	—	—
0035H	PULG	Port G pull-up register	R/W	00000000B
0036H	T01CR1	8/16-bit composite timer 01 status control register 1 ch. 0	R/W	00000000B
0037H	T00CR1	8/16-bit composite timer 00 status control register 1 ch. 0	R/W	00000000B
0038H	—	(Disabled)	—	—
0039H	—	(Disabled)	—	—
003AH to 0048H	—	(Disabled)	—	—
0049H	EIC10	External interrupt circuit control register ch. 2/ch. 3	R/W	00000000B

(Continued)

Address	Register abbreviation	Register name	R/W	Initial value
004A$_H$	EIC20	External interrupt circuit control register ch. 4/ch. 5	R/W	00000000$_B$
004B$_H$	EIC30	External interrupt circuit control register ch. 6/ch. 7	R/W	00000000$_B$
004C$_H$ to 004F$_H$	—	(Disabled)	—	—
0050$_H$	SCR	LIN-UART serial control register	R/W	00000000$_B$
0051$_H$	SMR	LIN-UART serial mode register	R/W	00000000$_B$
0052$_H$	SSR	LIN-UART serial status register	R/W	00001000$_B$
0053$_H$	RDR/TDR	LIN-UART receive/transmit data register	R/W	00000000$_B$
0054$_H$	ESCR	LIN-UART extended status control register	R/W	00000100$_B$
0055$_H$	ECCR	LIN-UART extended communication control register	R/W	000000XX$_B$
0056$_H$ to 006B$_H$	—	(Disabled)	—	—
006C$_H$	ADC1	8/10-bit A/D converter control register 1	R/W	00000000$_B$
006D$_H$	ADC2	8/10-bit A/D converter control register 2	R/W	00000000$_B$
006E$_H$	ADDH	8/10-bit A/D converter data register (Upper)	R/W	00000000$_B$
006F$_H$	ADDL	8/10-bit A/D converter data register (Lower)	R/W	00000000$_B$
0070$_H$	—	(Disabled)	—	—
0071$_H$	FSR2	Flash memory status register 2	R/W	00000000$_B$
0072$_H$	FSR	Flash memory status register	R/W	000X0000$_B$
0073$_H$	SWRE0	Flash memory sector write control register 0	R/W	00000000$_B$
0074$_H$	FSR3	Flash memory status register 3	R	0000XXXX$_B$
0075$_H$	—	(Disabled)	—	—
0076$_H$	WREN	Wild register address compare enable register	R/W	00000000$_B$
0077$_H$	WROR	Wild register data test setting register	R/W	00000000$_B$
0078$_H$	—	Mirror of register bank pointer (RP) and direct bank pointer (DP)	—	—
0079$_H$	ILR0	Interrupt level setting register 0	R/W	11111111$_B$
007A$_H$	ILR1	Interrupt level setting register 1	R/W	11111111$_B$
007B$_H$	ILR2	Interrupt level setting register 2	R/W	11111111$_B$
007C$_H$	ILR3	Interrupt level setting register 3	R/W	11111111$_B$
007D$_H$	ILR4	Interrupt level setting register 4	R/W	11111111$_B$
007E$_H$	ILR5	Interrupt level setting register 5	R/W	11111111$_B$
007F$_H$	—	(Disabled)	—	—

(Continued)

Address	Register abbreviation	Register name	R/W	Initial value
0F80H	WRARH0	Wild register address setting register (Upper) ch. 0	R/W	00000000B
0F81H	WRARL0	Wild register address setting register (Lower) ch. 0	R/W	00000000B
0F82H	WRDR0	Wild register data setting register ch. 0	R/W	00000000B
0F83H	WRARH1	Wild register address setting register (Upper) ch. 1	R/W	00000000B
0F84H	WRARL1	Wild register address setting register (Lower) ch. 1	R/W	00000000B
0F85H	WRDR1	Wild register data setting register ch. 1	R/W	00000000B
0F86H	WRARH2	Wild register address setting register (Upper) ch. 2	R/W	00000000B
0F87H	WRARL2	Wild register address setting register (Lower) ch. 2	R/W	00000000B
0F88H	WRDR2	Wild register data setting register ch. 2	R/W	00000000B
0F89H to 0F91H	—	(Disabled)	—	—
0F92H	T01CR0	8/16-bit composite timer 01 status control register 0 ch. 0	R/W	00000000B
0F93H	T00CR0	8/16-bit composite timer 00 status control register 0 ch. 0	R/W	00000000B
0F94H	T01DR	8/16-bit composite timer 01 data register ch. 0	R/W	00000000B
0F95H	T00DR	8/16-bit composite timer 00 data register ch. 0	R/W	00000000B
0F96H	TMCR0	8/16-bit composite timer 00/01 timer mode control register ch. 0	R/W	00000000B
0F97H	—	(Disabled)	—	—
0F98H	—	(Disabled)	—	—
0F99H	—	(Disabled)	—	—
0F9AH	—	(Disabled)	—	—
0F9BH	—	(Disabled)	—	—
0F9CH to 0FBBH	—	(Disabled)	—	—
0FBCH	BGR1	LIN-UART baud rate generator register 1	R/W	00000000B
0FBDH	BGR0	LIN-UART baud rate generator register 0	R/W	00000000B
0FBEH to 0FC2H	—	(Disabled)	—	—
0FC3H	AIDRL	A/D input disable register (Lower)	R/W	00000000B
0FC4H to 0FE3H	—	(Disabled)	—	—
0FE4H	CRTH	Main CR clock trimming register (Upper)	R/W	1XXXXXXXB
0FE5H	CRTL	Main CR clock trimming register (Lower)	R/W	000XXXXXB

(Continued)

(Continued)

Address	Register abbreviation	Register name	R/W	Initial value
0FE6H, 0FE7H	—	(Disabled)	—	—
0FE8H	SYSC	System configuration register	R/W	11000011B
0FE9H	CMCR	Clock monitoring control register	R/W	00000000B
0FEAH	CMDR	Clock monitoring data register	R/W	00000000B
0FEBH	WDTH	Watchdog timer selection ID register (Upper)	R/W	XXXXXXXXB
0FECH	WDTL	Watchdog timer selection ID register (Lower)	R/W	XXXXXXXXB
0FEDH	—	(Disabled)	—	—
0FEEH	ILSR	Input level select register	R/W	00000000B
0FEFH to 0FFFH	—	(Disabled)	—	—

• R/W access symbols
  R/W : Readable / Writable
  R : Read only

• Initial value symbols
  0 : The initial value of this bit is “0”.
  1 : The initial value of this bit is “1”.
  X : The initial value of this bit is undefined.

Note: Do not write to an address that is “(Disabled)”. If a “(Disabled)” address is read, an indeterminate value is returned.

■ INTERRUPT SOURCE TABLE (MB95260H Series)

Interrupt source	Interrupt request number	Vector table address		Bit name of interrupt level setting register	Priority order of interrupt sources of the same level (occurring simultaneously)
		Upper	Lower		
External interrupt ch. 4	IRQ00	FFFA$_H$	FFFB$_H$	L00 [1:0]	High
External interrupt ch. 5	IRQ01	FFF8$_H$	FFF9$_H$	L01 [1:0]	
External interrupt ch. 2	IRQ02	FFF6$_H$	FFF7$_H$	L02 [1:0]	
External interrupt ch. 6					
External interrupt ch. 3	IRQ03	FFF4$_H$	FFF5$_H$	L03 [1:0]	
External interrupt ch. 7					
—	IRQ04	FFF2$_H$	FFF3$_H$	L04 [1:0]	
8/16-bit composite timer ch. 0 (Lower)	IRQ05	FFF0$_H$	FFF1$_H$	L05 [1:0]	
8/16-bit composite timer ch. 0 (Upper)	IRQ06	FFEE$_H$	FFEF$_H$	L06 [1:0]	
LIN-UART (reception)	IRQ07	FFEC$_H$	FFED$_H$	L07 [1:0]	
LIN-UART (transmission)	IRQ08	FFEA$_H$	FFEB$_H$	L08 [1:0]	
—	IRQ09	FFE8$_H$	FFE9$_H$	L09 [1:0]	
—	IRQ10	FFE6$_H$	FFE7$_H$	L10 [1:0]	
—	IRQ11	FFE4$_H$	FFE5$_H$	L11 [1:0]	
—	IRQ12	FFE2$_H$	FFE3$_H$	L12 [1:0]	
—	IRQ13	FFE0$_H$	FFE1$_H$	L13 [1:0]	
8/16-bit composite timer ch. 1 (Upper)	IRQ14	FFDE$_H$	FFDF$_H$	L14 [1:0]	
—	IRQ15	FFDC$_H$	FFDD$_H$	L15 [1:0]	
—	IRQ16	FFDA$_H$	FFDB$_H$	L16 [1:0]	
—	IRQ17	FFD8$_H$	FFD9$_H$	L17 [1:0]	
8/10-bit A/D converter	IRQ18	FFD6$_H$	FFD7$_H$	L18 [1:0]	
Timebase timer	IRQ19	FFD4$_H$	FFD5$_H$	L19 [1:0]	
Watch prescaler	IRQ20	FFD2$_H$	FFD3$_H$	L20 [1:0]	
—	IRQ21	FFD0$_H$	FFD1$_H$	L21 [1:0]	
8/16-bit composite timer ch. 1 (Lower)	IRQ22	FFCE$_H$	FFCF$_H$	L22 [1:0]	
Flash memory	IRQ23	FFCC$_H$	FFCD$_H$	L23 [1:0]	Low

■ INTERRUPT SOURCE TABLE (MB95270H Series)

Interrupt source	Interrupt request number	Vector table address		Bit name of interrupt level setting register	Priority order of interrupt sources of the same level (occurring simultaneously)
		Upper	Lower		
External interrupt ch. 4	IRQ00	FFFA$_H$	FFFB$_H$	L00 [1:0]	High
—	IRQ01	FFF8$_H$	FFF9$_H$	L01 [1:0]	
—	IRQ02	FFF6$_H$	FFF7$_H$	L02 [1:0]	
External interrupt ch. 6					
—	IRQ03	FFF4$_H$	FFF5$_H$	L03 [1:0]	
—					
—	IRQ04	FFF2$_H$	FFF3$_H$	L04 [1:0]	
8/16-bit composite timer ch. 0 (Lower)	IRQ05	FFF0$_H$	FFF1$_H$	L05 [1:0]	
8/16-bit composite timer ch. 0 (Upper)	IRQ06	FFEE$_H$	FFEF$_H$	L06 [1:0]	
—	IRQ07	FFEC$_H$	FFED$_H$	L07 [1:0]	
—	IRQ08	FFEA$_H$	FFEB$_H$	L08 [1:0]	
—	IRQ09	FFE8$_H$	FFE9$_H$	L09 [1:0]	
—	IRQ10	FFE6$_H$	FFE7$_H$	L10 [1:0]	
—	IRQ11	FFE4$_H$	FFE5$_H$	L11 [1:0]	
—	IRQ12	FFE2$_H$	FFE3$_H$	L12 [1:0]	
—	IRQ13	FFE0$_H$	FFE1$_H$	L13 [1:0]	
—	IRQ14	FFDE$_H$	FFDF$_H$	L14 [1:0]	
—	IRQ15	FFDC$_H$	FFDD$_H$	L15 [1:0]	
—	IRQ16	FFDA$_H$	FFDB$_H$	L16 [1:0]	
—	IRQ17	FFD8$_H$	FFD9$_H$	L17 [1:0]	
8/10-bit A/D converter	IRQ18	FFD6$_H$	FFD7$_H$	L18 [1:0]	
Timebase timer	IRQ19	FFD4$_H$	FFD5$_H$	L19 [1:0]	
Watch prescaler	IRQ20	FFD2$_H$	FFD3$_H$	L20 [1:0]	
—	IRQ21	FFD0$_H$	FFD1$_H$	L21 [1:0]	
—	IRQ22	FFCE$_H$	FFCF$_H$	L22 [1:0]	
Flash memory	IRQ23	FFCC$_H$	FFCD$_H$	L23 [1:0]	Low

■ INTERRUPT SOURCE TABLE (MB95280H Series)

Interrupt source	Interrupt request number	Vector table address		Bit name of interrupt level setting register	Priority order of interrupt sources of the same level (occurring simultaneously)
		Upper	Lower		
External interrupt ch. 4	IRQ00	FFFA$_H$	FFFB$_H$	L00 [1:0]	High
External interrupt ch. 5	IRQ01	FFF8$_H$	FFF9$_H$	L01 [1:0]	
External interrupt ch. 2	IRQ02	FFF6$_H$	FFF7$_H$	L02 [1:0]	
External interrupt ch. 6					
External interrupt ch. 3	IRQ03	FFF4$_H$	FFF5$_H$	L03 [1:0]	
External interrupt ch. 7					
—	IRQ04	FFF2$_H$	FFF3$_H$	L04 [1:0]	
8/16-bit composite timer ch. 0 (Lower)	IRQ05	FFF0$_H$	FFF1$_H$	L05 [1:0]	
8/16-bit composite timer ch. 0 (Upper)	IRQ06	FFEE$_H$	FFEF$_H$	L06 [1:0]	
LIN-UART (reception)	IRQ07	FFEC$_H$	FFED$_H$	L07 [1:0]	
LIN-UART (transmission)	IRQ08	FFEA$_H$	FFEB$_H$	L08 [1:0]	
—	IRQ09	FFE8$_H$	FFE9$_H$	L09 [1:0]	
—	IRQ10	FFE6$_H$	FFE7$_H$	L10 [1:0]	
—	IRQ11	FFE4$_H$	FFE5$_H$	L11 [1:0]	
—	IRQ12	FFE2$_H$	FFE3$_H$	L12 [1:0]	
—	IRQ13	FFE0$_H$	FFE1$_H$	L13 [1:0]	
—	IRQ14	FFDE$_H$	FFDF$_H$	L14 [1:0]	
—	IRQ15	FFDC$_H$	FFDD$_H$	L15 [1:0]	
—	IRQ16	FFDA$_H$	FFDB$_H$	L16 [1:0]	
—	IRQ17	FFD8$_H$	FFD9$_H$	L17 [1:0]	
8/10-bit A/D converter	IRQ18	FFD6$_H$	FFD7$_H$	L18 [1:0]	
Timebase timer	IRQ19	FFD4$_H$	FFD5$_H$	L19 [1:0]	
Watch prescaler	IRQ20	FFD2$_H$	FFD3$_H$	L20 [1:0]	
—	IRQ21	FFD0$_H$	FFD1$_H$	L21 [1:0]	
—	IRQ22	FFCE$_H$	FFCF$_H$	L22 [1:0]	
Flash memory	IRQ23	FFCC$_H$	FFCD$_H$	L23 [1:0]	Low

■ ELECTRICAL CHARACTERISTICS

1. Absolute Maximum Ratings

Parameter	Symbol	Rating		Unit	Remarks
		Min	Max		
Power supply voltage*1	V_{CC}	V_{SS} – 0.3	V_{SS} + 6	V	
Input voltage*1	V_I	V_{SS} – 0.3	V_{SS} + 6	V	*2
Output voltage*1	V_O	V_{SS} – 0.3	V_{SS} + 6	V	*2
Maximum clamp current	I_{CLAMP}	– 2	+ 2	mA	Applicable to specific pins*3
Total maximum clamp current	$\Sigma\lvert I_{CLAMP}\rvert$	—	20	mA	Applicable to specific pins*3
"L" level maximum output current	I_{OL1}	—	15	mA	Other than P05, P06, P62 and P63*4
	I_{OL2}		15		P05, P06, P62 and P63*4
"L" level average current	I_{OLAV1}	—	4	mA	Other than P05, P06, P62 and P63*4 Average output current= operating current × operating ratio (1 pin)
	I_{OLAV2}		12		P05, P06, P62 and P63*4 Average output current= operating current × operating ratio (1 pin)
"L" level total maximum output current	ΣI_{OL}	—	100	mA	
"L" level total average output current	ΣI_{OLAV}	—	50	mA	Total average output current= operating current × operating ratio (Total number of pins)
"H" level maximum output current	I_{OH1}	—	– 15	mA	Other than P05, P06, P62 and P63*4
	I_{OH2}		– 15		P05, P06, P62 and P63*4
"H" level average current	I_{OHAV1}	—	– 4	mA	Other than P05, P06, P62 and P63*4 Average output current= operating current × operating ratio (1 pin)
	I_{OHAV2}		– 8		P05, P06, P62 and P63*4 Average output current= operating current × operating ratio (1 pin)
"H" level total maximum output current	ΣI_{OH}	—	– 100	mA	
"H" level total average output current	ΣI_{OHAV}	—	– 50	mA	Total average output current= operating current × operating ratio (Total number of pins)
Power consumption	Pd	—	320	mW	
Operating temperature	T_A	– 40	+ 85	°C	
Storage temperature	Tstg	– 55	+ 150	°C	

(Continued)

(Continued)

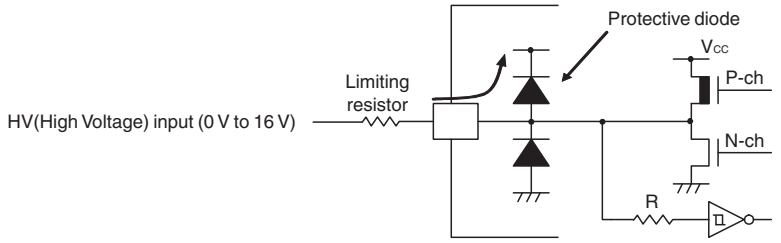
*1: The parameter is based on V_{SS} = 0.0 V.

*2: V_I and V_O must not exceed V_{CC} + 0.3 V. V_I must not exceed the rated voltage. However, if the maximum current to/from an input is limited by means of an external component, the I_{CLAMP} rating is used instead of the V_I rating.

*3: Applicable to the following pins: P00 to P07, P62 to P64, PG1, PG2, PF0, PF1 (P00, P62, P63 and P64 are available only in MB95F262H/F262K/F263H/F263K/F264H/F264K. P01, P02, P03, P07, PG1, PG2, PF0 and PF1 are available only in MB95F262H/F262K/F263H/F263K/F264H/F264K/F282H/F282K/F283H/F283K/F284H/F284K.)

- Use under recommended operating conditions.
- Use with DC voltage (current).
- The HV (High Voltage) signal is an input signal exceeding the V_{CC} voltage. Always connect a limiting resistor between the HV (High Voltage) signal and the microcontroller before applying the HV (High Voltage) signal.
- The value of the limiting resistor should be set to a value at which the current to be input to the microcontroller pin when the HV (High Voltage) signal is input is below the standard value, irrespective of whether the current is transient current or stationary current.
- When the microcontroller drive current is low, such as in low power consumption modes, the HV (High Voltage) input potential may pass through the protective diode to increase the potential of the V_{CC} pin, affecting other devices.
- If the HV (High Voltage) signal is input when the microcontroller power supply is off (not fixed at 0 V), since power is supplied from the pins, incomplete operations may be executed.
- If the HV (High Voltage) input is input after power-on, since power is supplied from the pins, the voltage of power supply may not be sufficient to enable a power-on reset.
- Do not leave the HV (High Voltage) input pin unconnected.
- Example of a recommended circuit:

  - Input/Output equivalent circuit



*4: P62 and P63 are available only in MB95F262H/F262K/F263H/F263K/F264H/F264K.

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.

2. Recommended Operating Conditions

(V_{SS} = 0.0 V)

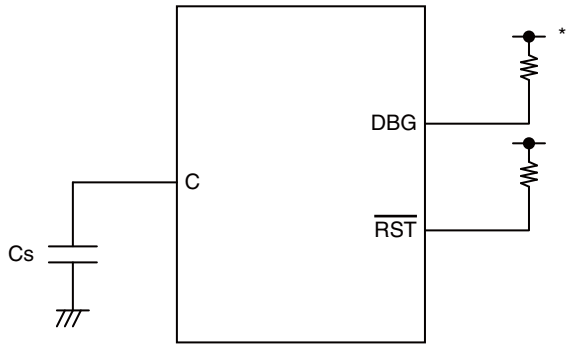
Parameter	Symbol	Value		Unit	Remarks	
		Min	Max			
Power supply voltage	V_{CC}	2.4*1*2	5.5*1	V	In normal operation	Other than on-chip debug mode
		2.3	5.5		Hold condition in stop mode	
		2.9	5.5		In normal operation	On-chip debug mode
		2.3	5.5		Hold condition in stop mode	
Smoothing capacitor	C_S	0.022	1	µF	*3	
Operating temperature	T_A	-40	+ 85	°C	Other than on-chip debug mode	
		+ 5	+ 35		On-chip debug mode	

*1: The value varies depending on the operating frequency, the machine clock and the analog guaranteed range.

*2: The value is 2.88 V when the low-voltage detection reset is used.

*3: Use a ceramic capacitor or a capacitor with equivalent frequency characteristics. The bypass capacitor for the V_{CC} pin must have a capacitance larger than C_S. For the connection to a smoothing capacitor C_S, see the diagram below. To prevent the device from unintentionally entering an unknown mode due to noise, minimize the distance between the C pin and C_S and the distance between C_S and the V_{SS} pin when designing the layout of a printed circuit board.

- DBG / $\overline{\text{RST}}$ / C pins connection diagram



*: Since the DBG pin becomes a communication pin in on-chip debug mode, set a pull-up resistor value suiting the input/output specifications of P12/DBG.

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.

3. DC Characteristics

(V_{CC} = 5.0 V±10%, V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

Parameter	Symbol	Pin name	Condition	Value			Unit	Remarks
				Min	Typ	Max		
"H" level input voltage	V_{IHI}	P04	*1	0.7 V_{CC}	—	V_{CC} + 0.3	V	When CMOS input level (hysteresis input) is selected
	V_{IHS}	P00 to P07, P12, P62 to P64, PF0, PF1, PG1, PG2	*1	0.8 V_{CC}	—	V_{CC} + 0.3	V	Hysteresis input
	V_{IHM}	PF2	—	0.7 V_{CC}	—	V_{CC} + 0.3	V	Hysteresis input
"L" level input voltage	V_{IL}	P04	*1	V_{SS} – 0.3	—	0.3 V_{CC}	V	When CMOS input level (hysteresis input) is selected
	V_{ILS}	P00 to P07, P12, P62 to P64, PF0, PF1, PG1, PG2	*1	V_{SS} – 0.3	—	0.2 V_{CC}	V	Hysteresis input
	V_{ILM}	PF2	—	V_{SS} – 0.3	—	0.3 V_{CC}	V	Hysteresis input
Open-drain output application voltage	V_D	PF2, P12	—	V_{SS} – 0.3	—	Vss + 5.5	V	
"H" level output voltage	V_{OH1}	Output pins other than P05, P06, P12, P62, P63, PF2*2	I_{OH} = – 4 mA	V_{CC} – 0.5	—	—	V	
	V_{OH2}	P05, P06, P62, P63*2	I_{OH} = – 8 mA	V_{CC} – 0.5	—	—	V	
"L" level output voltage	V_{OL1}	Output pins other than P05, P06, P62, P63*2	I_{OL} = 4 mA	—	—	0.4	V	
	V_{OL2}	P05, P06, P62, P63*2	I_{OL} = 12 mA	—	—	0.4	V	
Input leak current (Hi-Z output leak current)	I_{LI}	All input pins	0.0 V < V_I < V_{CC}	– 5	—	+ 5	µA	When pull-up resistance is disabled
Pull-up resistance	R_{PULL}	P00 to P07, PG1, PG2*3*4	V_I = 0 V	25	50	100	kΩ	When pull-up resistance is enabled
Input capacitance	C_{IN}	Other than V_{CC} and V_{SS}	f = 1 MHz	—	5	15	pF	

(Continued)

(V_{CC} = 5.0 V±10%, V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

Parameter	Symbol	Pin name	Condition	Value			Unit	Remarks
				Min	Typ	Max		
Power supply current*4	I_{CC}	V_{CC} (External clock operation)	V_{CC} = 5.5 V F_{CH} = 32 MHz F_{MP} = 16 MHz Main clock mode (divided by 2)	—	13	17	mA	Flash memory product (except writing and erasing)
				—	33.5	39.5	mA	Flash memory product (at writing and erasing)
				—	15	21	mA	At A/D conversion
	I_{CCS}		V_{CC} = 5.5 V F_{CH} = 32 MHz F_{MP} = 16 MHz Main sleep mode (divided by 2)	—	5.5	9	mA	
	I_{CCL}		V_{CC} = 5.5 V F_{CL} = 32 kHz F_{MPL} = 16 kHz Subclock mode (divided by 2) T_A = + 25°C	—	65	153	µA	
	I_{CCLS}		V_{CC} = 5.5 V F_{CL} = 32 kHz F_{MPL} = 16 kHz Subsleep mode (divided by 2) T_A = + 25°C	—	10	84	µA	
	I_{CCT}		V_{CC} = 5.5 V F_{CL} = 32 kHz Watch mode Main stop mode T_A = + 25°C	—	5	30	µA	
	I_{CCMCR}	V_{CC}	V_{CC} = 5.5 V F_{CRH} = 10 MHz F_{MP} = 10 MHz Main CR clock mode	—	8.6	—	mA	
	I_{CCSCR}		V_{CC} = 5.5 V Sub-CR clock mode (divided by 2) T_A = + 25°C	—	110	410	µA	

(Continued)

(Continued)

(V_{CC} = 5.0 V±10%, V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

Parameter	Symbol	Pin name	Condition	Value			Unit	Remarks
				Min	Typ	Max		
Power supply current*4	I_{CCTS}	V_{CC} (External clock operation)	V_{CC} = 5.5 V F_{CH} = 32 MHz Timebase timer mode T_A = + 25°C	—	1.1	3	mA	
	I_{CCH}		V_{CC} = 5.5 V Substop mode T_A = + 25°C	—	3.5	22.5	µA	Main stop mode for single external clock selection
	I_{LVD}	V_{CC}	Current consumption for low-voltage detection circuit only	—	37	54	µA	
	I_{CRH}		Current consumption for the main CR oscillator	—	0.5	0.6	mA	
	I_{CRL}		Current consumption for the sub-CR oscillator oscillating at 100 kHz	—	20	72	µA	

*1: The input level of P04 can be switched between “CMOS input level” and “hysteresis input level”. The input level selection register (ILSR) is used to switch between the two input levels.

*2: P62 and P63 are available only in MB95F262H/F262K/F263H/F263K/F264H/F264K.

*3: P00 is available only in MB95F262H/F262K/F263H/F263K/F264H/F264K. P01, P02, P03, P07, PG1 and PG2 are available only in MB95F262H/F262K/F263H/F263K/F264H/F264K/F282H/F282K/F283H/F283K/F284H/F284K.

*4:
- The power supply current is determined by the external clock. When the low-voltage detection option is selected, the power-supply current will be the sum of adding the current consumption of the low-voltage detection circuit (I_{LVD}) to one of the value from I_{CC} to I_{CCH}. In addition, when both the low-voltage detection option and the CR oscillator are selected, the power supply current will be the sum of adding up the current consumption of the low-voltage detection circuit, the current consumption of the CR oscillators (I_{CRH}, I_{CRL}) and a specified value. In on-chip debug mode, the CR oscillator (I_{CRH}) and the low-voltage detection circuit are always enabled, and current consumption therefore increases accordingly.
- See "4. AC Characteristics: (1) Clock Timing" for F_{CH} and F_{CL}.
- See "4. AC Characteristics: (2) Source Clock / Machine Clock" for F_{MP} and F_{MPL}.

4. AC Characteristics

(1) Clock Timing

(V_{CC} = 2.4 V to 5.5 V, V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

Parameter	Symbol	Pin name	Condition	Value			Unit	Remarks
				Min	Typ	Max		
Clock frequency	F_{CH}	X0, X1	—	1	—	16.25	MHz	When the main oscillation circuit is used
		X0	X1 : open	1	—	12	MHz	When the main external clock is used
		X0, X1	*1	1	—	32.5	MHz	
		HCLK1, HCLK2	—					
	F_{CRH}	—	—	9.7	10	10.3	MHz	When the main CR clock is used*2 3.3 V ≤ Vcc ≤ 5.5 V(-40 °C ≤ T_A ≤ + 40 °C) 2.4 V ≤ Vcc < 3.3 V(0 °C ≤ T_A ≤ + 40 °C)
				7.76	8	8.24	MHz	
				0.97	1	1.03	MHz	
				9.55	10	10.45	MHz	When the main CR clock is used*2 3.3 V ≤ Vcc ≤ 5.5 V (+ 40 °C < T_A ≤ + 85 °C)
				7.64	8	8.36	MHz	
				0.955	1	1.045	MHz	
				9.5	10	10.5	MHz	When the main CR clock is used*2 2.4 V ≤ Vcc < 3.3 V (-40 °C ≤ T_A < 0 °C, + 40 °C < T_A ≤ + 85 °C)
				7.6	8	8.4	MHz	
				0.95	1	1.05	MHz	
				9.7	10	10.3	MHz	When the main CR clock is used*3 2.4 V ≤ Vcc ≤ 5.5 V(0 °C ≤ T_A ≤ + 40 °C)
				7.76	8	8.24	MHz	
				0.97	1	1.03	MHz	
				9.5	10	10.5	MHz	When the main CR clock is used*3 2.4 V ≤ Vcc ≤ 5.5 V (-40 °C ≤ T_A < 0 °C, + 40 °C < T_A ≤ + 85 °C)
				7.6	8	8.4	MHz	
				0.95	1	1.05	MHz	
	F_{CL}	X0A, X1A	—	—	32.768	—	kHz	When the sub oscillation circuit is used
				—	32.768	—	kHz	When the sub-external clock is used
	F_{CRL}	—	—	50	100	200	kHz	When the sub CR clock is used
Clock cycle time	t_{HCYL}	X0, X1	—	61.5	—	1000	ns	When the main oscillation circuit is used
		X0	X1 : open	83.4	—	1000	ns	When the external clock is used
		X0, X1	*1	30.8	—	1000	ns	
		HCLK1, HCLK2	—					
	t_{LCYL}	X0A, X1A	—	—	30.5	—	µs	When the subclock is used

(Continued)

(Continued)

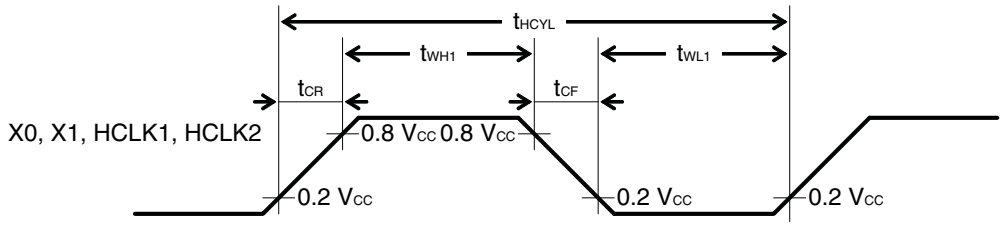
(V_{CC} = 2.4 V to 5.5 V, V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

Parameter	Symbol	Pin name	Condition	Value			Unit	Remarks
				Min	Typ	Max		
Input clock pulse width	t_{WH1} t_{WL1}	X0	X1 : open	33.4	—	—	ns	When the external clock is used, the duty ratio should range between 40% and 60%.
		X0, X1	*1	12.4	—	—	ns	
		HCLK1, HCLK2	—					
	t_{WH2} t_{WL2}	X0A	—	—	15.2	—	µs	
Input clock rise time and fall time	t_{CR} t_{CF}	X0	X1 : open	—	—	5	ns	When the external clock is used
		X0, X1	*1	—	—	5	ns	
		HCLK1, HCLK2	—					
CR oscillation start time	t_{CRHWK}	—	—	—	—	80	µs	When the main CR clock is used
	t_{CRLWK}	—	—	—	—	10	µs	When the sub CR clock is used

*1: The external clock signal is input to X0 and the inverted external clock signal to X1.

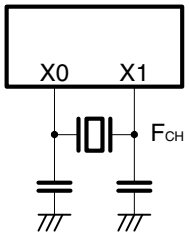
*2: These specifications are not applicable to the following products: MB95F272HPH, MB95F272KPH, MB95F273HPH, MB95F273KPH, MB95F274HPH, MB95F274KPH, MB95F282HPH, MB95F282KPH, MB95F283HPH, MB95F283KPH, MB95F284HPH and MB95F284KPH.

*3: These specifications are only applicable to the following products: MB95F272HPH, MB95F272KPH, MB95F273HPH, MB95F273KPH, MB95F274HPH, MB95F274KPH, MB95F282HPH, MB95F282KPH, MB95F283HPH, MB95F283KPH, MB95F284HPH and MB95F284KPH.

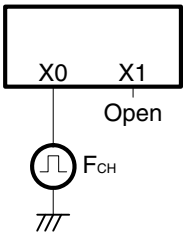


- Figure of main clock input port external connection

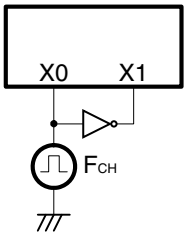
When a crystal oscillator or a ceramic oscillator is used



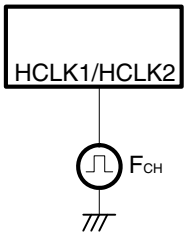
When the external clock is used (X1 is open)

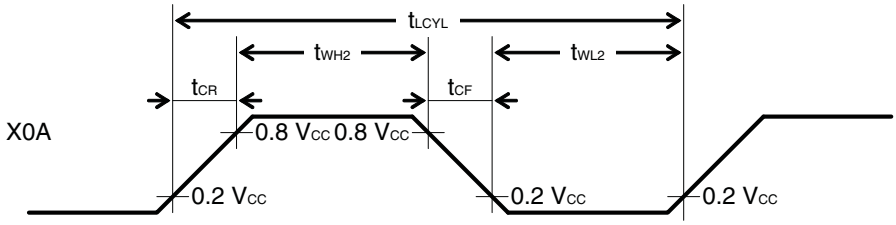


When the external clock is used



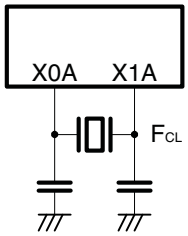
When the external clock is used



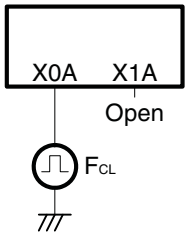


- Figure of subclock input port external connection

When a crystal oscillator or a ceramic oscillator is used



When the external clock is used



(2) Source Clock / Machine Clock

(V_{CC} = 5.0 V±10%, V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

Parameter	Symbol	Pin name	Value			Unit	Remarks
			Min	Typ	Max		
Source clock cycle time*1	t_{SCLK}	—	61.5	—	2000	ns	When the main external clock is used Min: F_{CH} = 32.5 MHz, divided by 2 Max: F_{CH} = 1 MHz, divided by 2
			100	—	1000	ns	When the main CR clock is used Min: F_{CRH} = 10 MHz Max: F_{CRH} = 1 MHz
			—	61	—	µs	When the sub-oscillation clock is used F_{CL} = 32.768 kHz, divided by 2
			—	20	—	µs	When the sub CR clock is used F_{CRL} = 100 kHz, divided by 2
Source clock frequency	F_{SP}	—	0.5	—	16.25	MHz	When the main oscillation clock is used
			1	—	10	MHz	When the main CR clock is used
	F_{SPL}		—	16.384	—	kHz	When the sub-oscillation clock is used
			—	50	—	kHz	When the sub-CR clock is used F_{CRL} = 100 kHz, divided by 2
Machine clock cycle time*2 (minimum instruction execution time)	t_{MCLK}	—	61.5	—	32000	ns	When the main oscillation clock is used Min: F_{SP} = 16.25 MHz, no division Max: F_{SP} = 0.5 MHz, divided by 16
			100	—	16000	ns	When the main CR clock is used Min: F_{SP} = 10 MHz Max: F_{SP} = 1 MHz, divided by 16
			61	—	976.5	µs	When the sub-oscillation clock is used Min: F_{SPL} = 16.384 kHz, no division Max: F_{SPL} = 16.384 kHz, divided by 16
			20	—	320	µs	When the sub-CR clock is used Min: F_{SPL} = 50 kHz, no division Max: F_{SPL} = 50 kHz, divided by 16
Machine clock frequency	F_{MP}	—	0.031	—	16.25	MHz	When the main oscillation clock is used
			0.0625	—	10	MHz	When the main CR clock is used
	F_{MPL}		1.024	—	16.384	kHz	When the sub-oscillation clock is used
			3.125	—	50	kHz	When the sub-CR clock is used F_{CRL} = 100 kHz

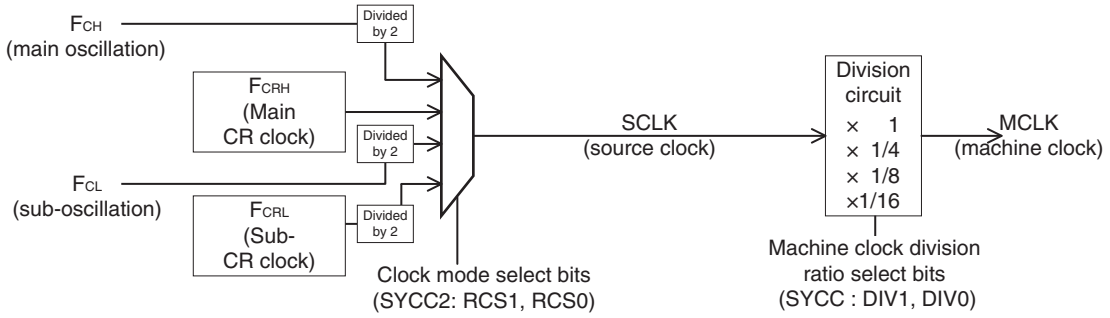
*1: This is the clock before it is divided according to the division ratio set by the machine clock division ratio select bits (SYCC : DIV1 and DIV0) . This source clock is divided to become a machine clock according to the division ratio set by the machine clock division ratio select bits (SYCC : DIV1 and DIV0). In addition, a source clock can be selected from the following.

- Main clock divided by 2
- Main CR clock
- Subclock divided by 2
- Sub-CR clock divided by 2

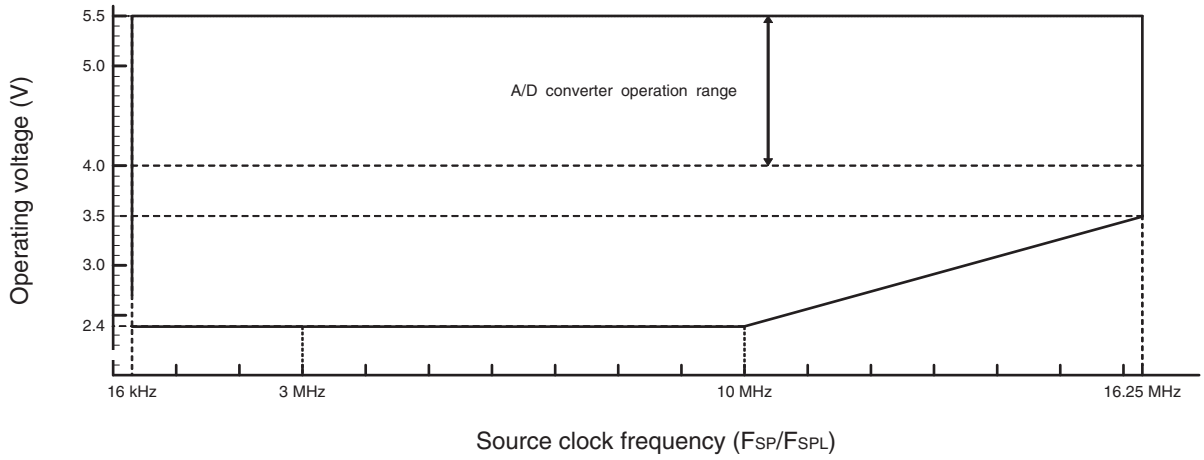
*2: This is the operating clock of the microcontroller. A machine clock can be selected from the following.

- Source clock (no division)
- Source clock divided by 4
- Source clock divided by 8
- Source clock divided by 16

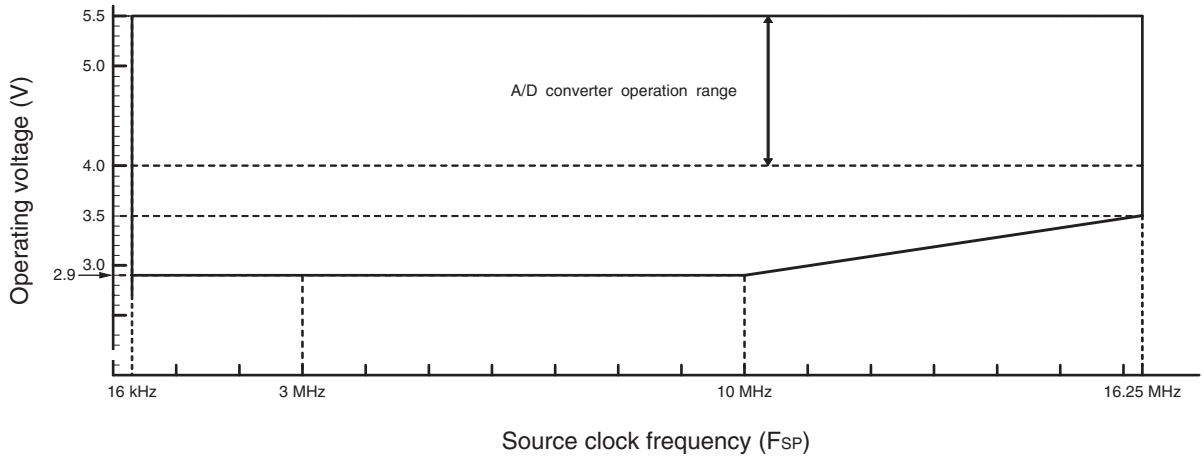
• Schematic diagram of the clock generation block



• Operating voltage - Operating frequency (When T_A = -40°C to + 85°C)
MB95260H/270H/280H (without the on-chip debug function)



• Operating voltage - Operating frequency (When T_A = -40°C to + 85°C)
MB95260H/270H/280H (with the on-chip debug function)



(3) External Reset

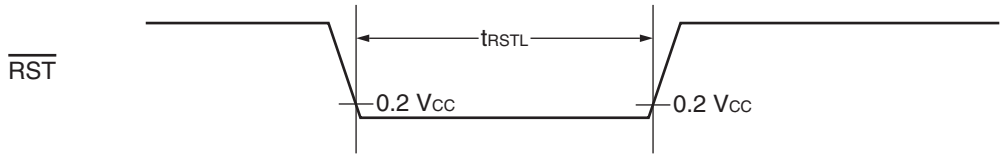
(V_{CC} = 5.0 V±10%, V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

Parameter	Symbol	Value		Unit	Remarks
		Min	Max		
$\overline{RST}$ "L" level pulse width	t_{RSTL}	2 t_{MCLK}*1	—	ns	In normal operation
		Oscillation time of the oscillator*2 + 100	—	µs	In stop mode, subclock mode, sub-sleep mode, watch mode, and power-on
		100	—	µs	In timebase timer mode

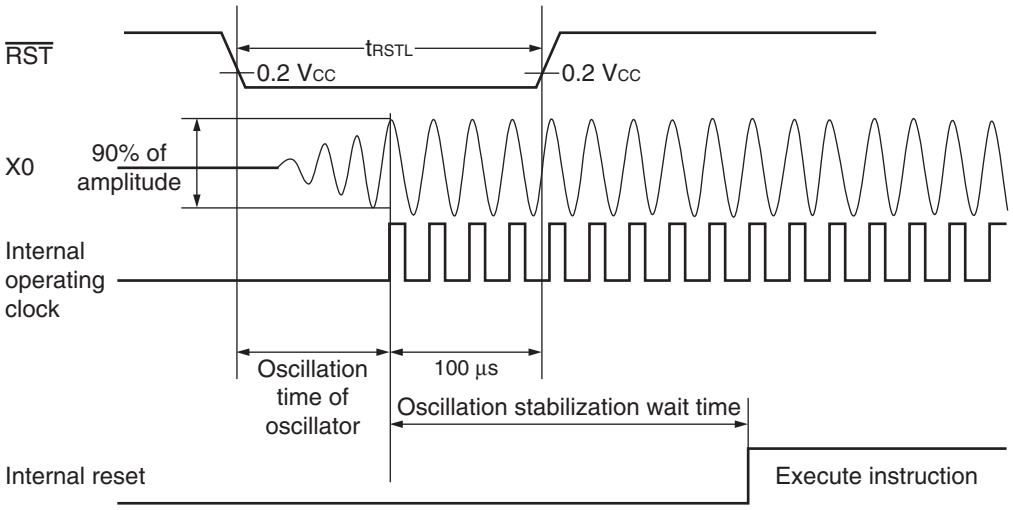
*1 : See " (2) Source Clock / Machine Clock" for t_{MCLK}.

*2 : The oscillation time of an oscillator is the time for it to reach 90% of its amplitude. The crystal oscillator has an oscillation time of between several ms and tens of ms. The ceramic oscillator has an oscillation time of between hundreds of µs and several ms. The external clock has an oscillation time of 0 ms. The CR oscillator clock has an oscillation time of between several µs and several ms.

- In normal operation



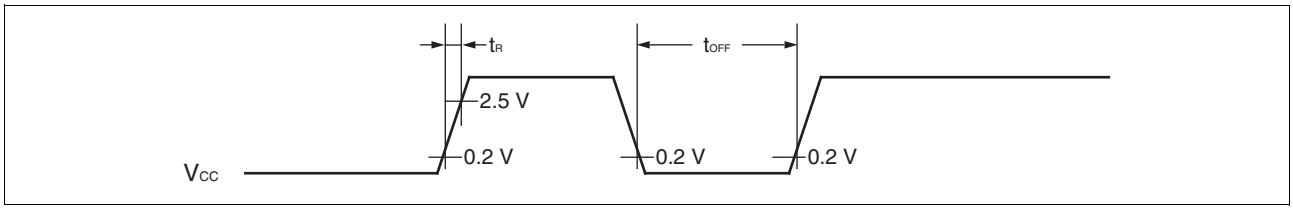
- In stop mode, subclock mode, subsleep mode, watch mode and power-on



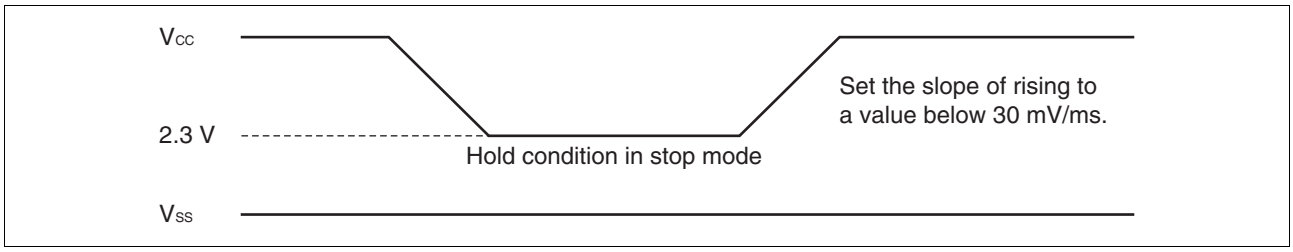
(4) Power-on Reset

(V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

Parameter	Symbol	Condition	Value		Unit	Remarks
			Min	Max		
Power supply rising time	t_R	—	—	50	ms	
Power supply cutoff time	t_{OFF}	—	1	—	ms	Wait time until power-on



Note: A sudden change of power supply voltage may activate the power-on reset function. When changing the power supply voltage during the operation, set the slope of rising to a value below within 30 mV/ms as shown below.



(5) Peripheral Input Timing

(V_{CC} = 5.0 V±10%, V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

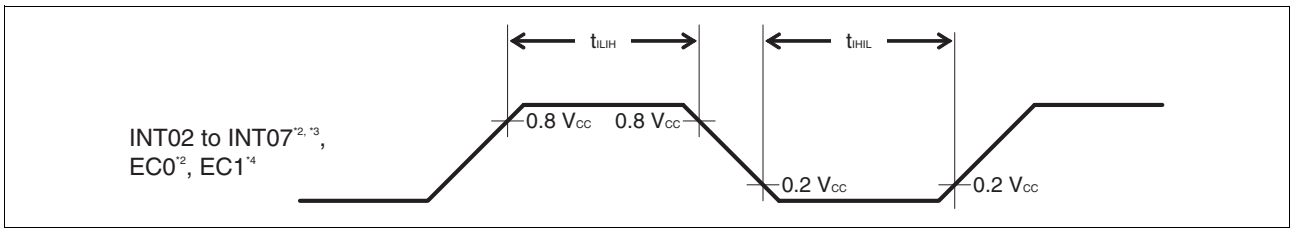
Parameter	Symbol	Pin name	Value		Unit
			Min	Max	
Peripheral input “H” pulse width	t_{ILIH}	INT02 to INT07*2,*3, EC0*2, EC1*4	2 t_{MCLK}*1	—	ns
Peripheral input “L” pulse width	t_{IHIL}		2 t_{MCLK}*1	—	ns

*1: See “(2) Source Clock / Machine Clock” for t_{MCLK}.

*2: INT04, INT06 and EC0 are available in all products.

*3: INT02, INT03, INT05 and INT07 are available only in MB95F262H/F262K/F263H/F263K/F264H/F264K/F282H/F282K/F283H/F283K/F284H/F284K.

*4: EC1 is available only in MB95F262H/F262K/F263H/F263K/F264H/F264K.



(6) LIN-UART Timing (Available only in MB95F262H/F262K/F263H/F263K/F264H/F264K/F282H/F282K/F283H/F283K/F284H/F284K)

Sampling is executed at the rising edge of the sampling clock*1, and serial clock delay is disabled*2. (ESCR register: SCES bit = 0, ECCR register: SCDE bit = 0)

(V_{CC} = 5.0 V±10%, AV_{SS} = V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

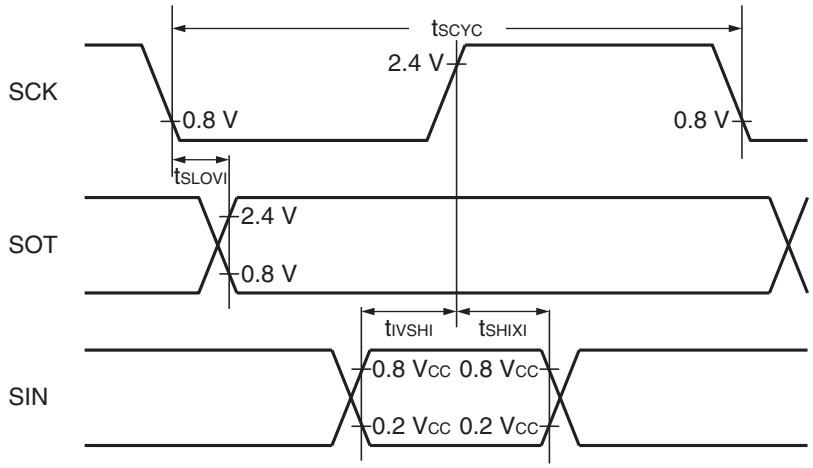
Parameter	Symbol	Pin name	Condition	Value		Unit
				Min	Max	
Serial clock cycle time	t_{SCYC}	SCK	Internal clock operation output pin: C_L = 80 pF + 1 TTL	5 t_{MCLK}*3	—	ns
SCK ↓→ SOT delay time	t_{SLOVI}	SCK, SOT		– 95	+ 95	ns
Valid SIN → SCK ↑	t_{IVSHI}	SCK, SIN		t_{MCLK}*3 + 190	—	ns
SCK ↑→ valid SIN hold time	t_{SHIXI}	SCK, SIN		0	—	ns
Serial clock “L” pulse width	t_{SLSH}	SCK	External clock operation output pin: C_L = 80 pF + 1 TTL	3 t_{MCLK}*3 – t_R	—	ns
Serial clock “H” pulse width	t_{SHSL}	SCK		t_{MCLK}*3 + 95	—	ns
SCK ↓→ SOT delay time	t_{SLOVE}	SCK, SOT		—	2 t_{MCLK}*3 + 95	ns
Valid SIN → SCK ↑	t_{IVSHE}	SCK, SIN		190	—	ns
SCK ↑→ valid SIN hold time	t_{SHIXE}	SCK, SIN		t_{MCLK}*3 + 95	—	ns
SCK fall time	t_F	SCK		—	10	ns
SCK rise time	t_R	SCK		—	10	ns

*1: There is a function used to choose whether the sampling of reception data is performed at a rising edge or a falling edge of the serial clock.

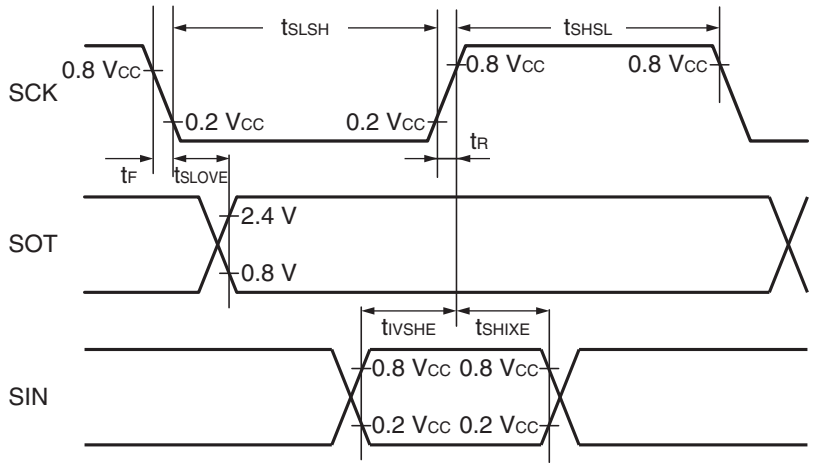
*2: The serial clock delay function is a function used to delay the output signal of the serial clock for half the clock.

*3: See “(2) Source Clock / Machine Clock” for t_{MCLK}.

- Internal shift clock mode



- External shift clock mode



Sampling is executed at the falling edge of the sampling clock*1, and serial clock delay is disabled*2. (ESCR register: SCES bit = 1, ECCR register: SCDE bit = 0)

(V_{CC} = 5.0 V±10%, V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

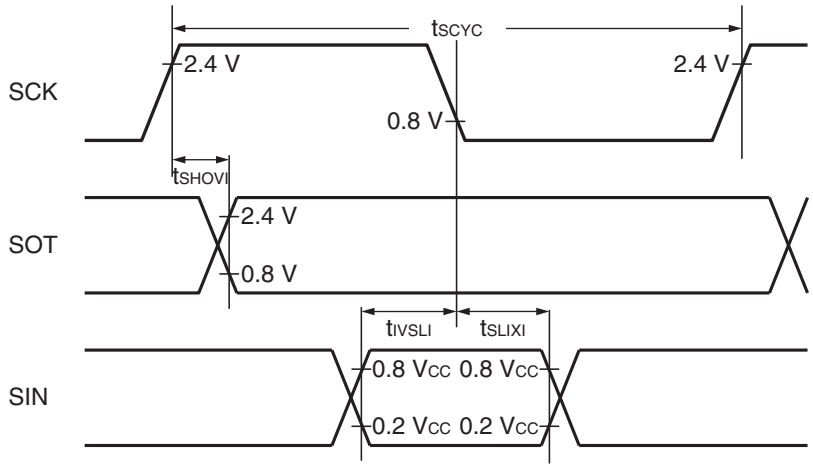
Parameter	Symbol	Pin name	Condition	Value		Unit
				Min	Max	
Serial clock cycle time	t_{SCYC}	SCK	Internal clock operation output pin: C_L = 80 pF + 1 TTL	5 t_{MCLK}*3	—	ns
SCK ↑→ SOT delay time	t_{SHOVI}	SCK, SOT		− 95	+ 95	ns
Valid SIN → SCK ↓	t_{IVSLI}	SCK, SIN		t_{MCLK}*3 + 190	—	ns
SCK ↓→ valid SIN hold time	t_{SLIXI}	SCK, SIN		0	—	ns
Serial clock “H” pulse width	t_{SHSL}	SCK	External clock operation output pin: C_L = 80 pF + 1 TTL	3 t_{MCLK}*3 − t_R	—	ns
Serial clock “L” pulse width	t_{SLSH}	SCK		t_{MCLK}*3 + 95	—	ns
SCK ↑→ SOT delay time	t_{SHOVE}	SCK, SOT		—	2 t_{MCLK}*3 + 95	ns
Valid SIN → SCK ↓	t_{IVSLE}	SCK, SIN		190	—	ns
SCK ↓→ valid SIN hold time	t_{SLIXE}	SCK, SIN		t_{MCLK}*3 + 95	—	ns
SCK fall time	t_F	SCK		—	10	ns
SCK rise time	t_R	SCK		—	10	ns

*1: There is a function used to choose whether the sampling of reception data is performed at a rising edge or a falling edge of the serial clock.

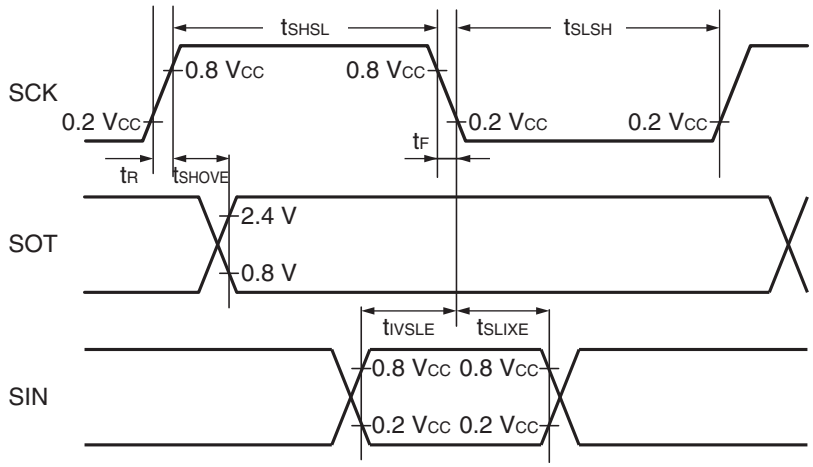
*2: The serial clock delay function is a function used to delay the output signal of the serial clock for half the clock.

*3: See “(2) Source Clock / Machine Clock” for t_{MCLK}.

- Internal shift clock mode



- External shift clock mode



Sampling is executed at the rising edge of the sampling clock*1, and serial clock delay is enabled*2. (ESCR register: SCES bit = 0, ECCR register: SCDE bit = 1)

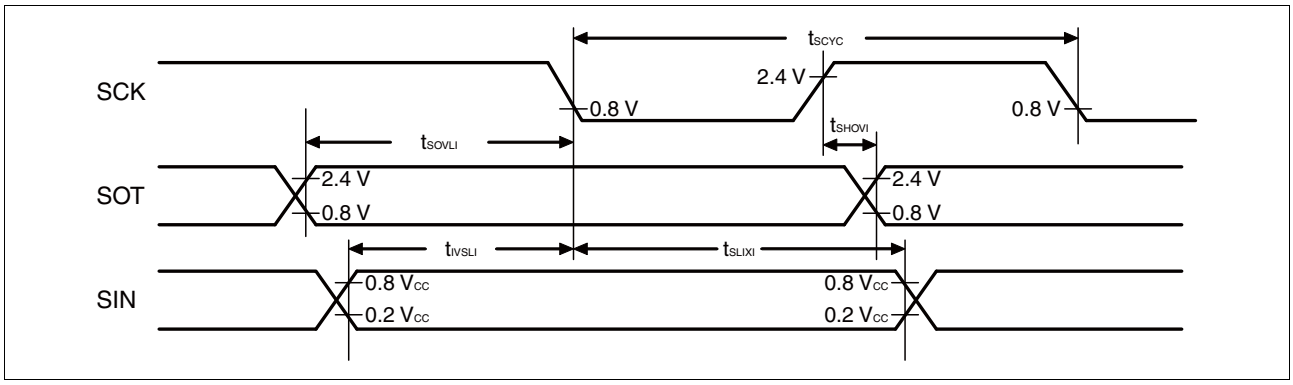
(V_{CC} = 5.0 V±10%, V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

Parameter	Symbol	Pin name	Condition	Value		Unit
				Min	Max	
Serial clock cycle time	t_{SCYC}	SCK	Internal clock operation output pin: C_L = 80 pF + 1 TTL	5 t_{MCLK}*3	—	ns
SCK ↑→ SOT delay time	t_{SHOVI}	SCK, SOT		− 95	+ 95	ns
Valid SIN → SCK ↓	t_{IVSLI}	SCK, SIN		t_{MCLK}*3 + 190	—	ns
SCK ↓→ valid SIN hold time	t_{SLIXI}	SCK, SIN		0	—	ns
SOT → SCK ↓ delay time	t_{SOVLI}	SCK, SOT		—	4 t_{MCLK}*3	ns

*1: There is a function used to choose whether the sampling of reception data is performed at a rising edge or a falling edge of the serial clock.

*2: The serial clock delay function is a function that delays the output signal of the serial clock for half clock.

*3: See “(2) Source Clock / Machine Clock” for t_{MCLK}.



Sampling is executed at the falling edge of the sampling clock*1, and serial clock delay is enabled*2. (ESCR register: SCES bit = 1, ECCR register: SCDE bit = 1)

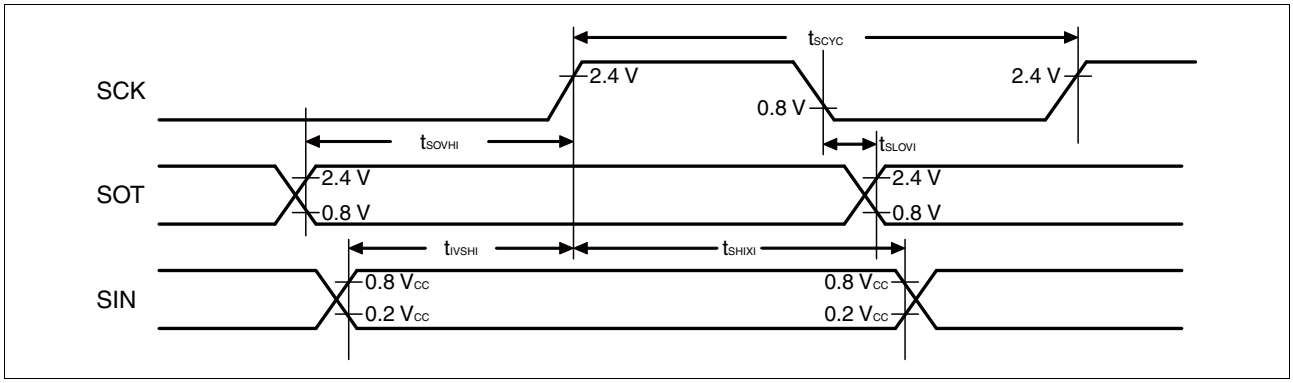
(V_{CC} = 5.0 V±10%, V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

Parameter	Symbol	Pin name	Condition	Value		Unit
				Min	Max	
Serial clock cycle time	t_{SCYC}	SCK	Internal clock operating output pin: C_L = 80 pF + 1 TTL	5 t_{MCLK}*3	—	ns
SCK ↓→ SOT delay time	t_{SLOVI}	SCK, SOT		− 95	+ 95	ns
Valid SIN → SCK ↑	t_{IVSHI}	SCK, SIN		t_{MCLK}*3 + 190	—	ns
SCK ↑→ valid SIN hold time	t_{SHIXI}	SCK, SIN		0	—	ns
SOT → SCK ↑ delay time	t_{SOVHI}	SCK, SOT		—	4 t_{MCLK}*3	ns

*1: There is a function used to choose whether the sampling of reception data is performed at a rising edge or a falling edge of the serial clock.

*2: The serial clock delay function is a function that delays the output signal of the serial clock for half clock.

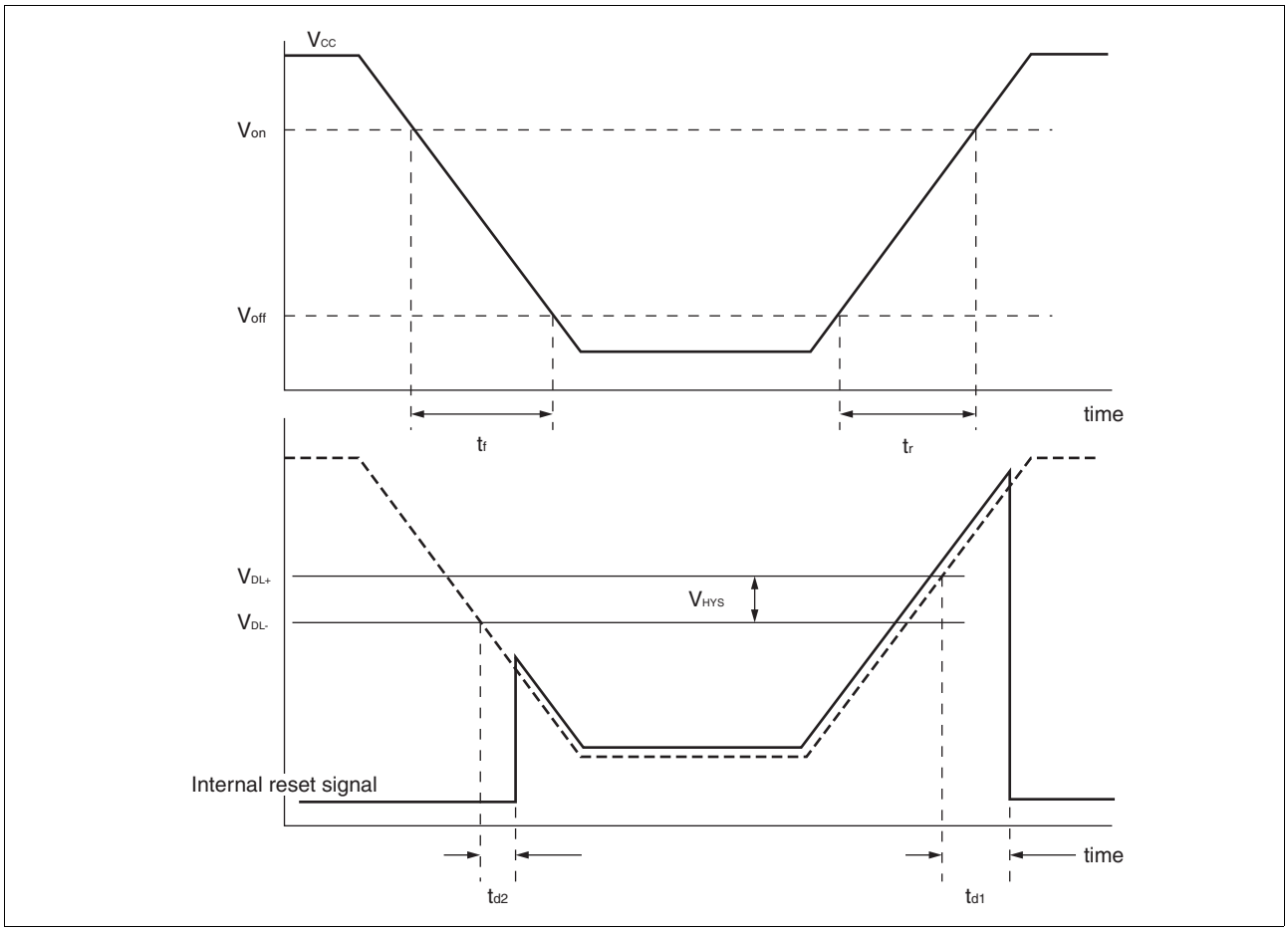
*3: See “(2) Source Clock / Machine Clock” for t_{MCLK}.



(7) Low-voltage Detection

(V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

Parameter	Symbol	Value			Unit	Remarks
		Min	Typ	Max		
Release voltage	V_{DL+}	2.52	2.7	2.88	V	At power supply rise
Detection voltage	V_{DL-}	2.42	2.6	2.78	V	At power supply fall
Hysteresis width	V_{HYS}	70	100	—	mV	
Power supply start voltage	V_{off}	—	—	2.3	V	
Power supply end voltage	V_{on}	4.9	—	—	V	
Power supply voltage change time (at power supply rise)	t_r	3000	—	—	µs	Slope of power supply that the reset release signal generates within the rating (V_{DL+})
Power supply voltage change time (at power supply fall)	t_f	300	—	—	µs	Slope of power supply that the reset detection signal generates within the rating (V_{DL-})
Reset release delay time	t_{d1}	—	—	300	µs	
Reset detection delay time	t_{d2}	—	—	20	µs	



5. A/D Converter

(1) A/D Converter Electrical Characteristics

(V_{CC} = 4.0 V to 5.5 V, V_{SS} = 0.0 V, T_A = -40°C to + 85°C)

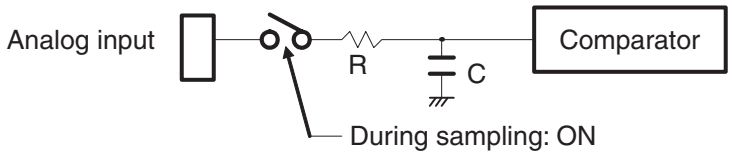
Parameter	Symbol	Value			Unit	Remarks
		Min	Typ	Max		
Resolution	—	—	—	10	bit	
Total error		− 3	—	+ 3	LSB	
Linearity error		− 2.5	—	+ 2.5	LSB	
Differential linear error		− 1.9	—	+ 1.9	LSB	
Zero transition voltage	V_{OT}	V_{SS} − 1.5 LSB	V_{SS} + 0.5 LSB	V_{SS} + 2.5 LSB	V	
Full-scale transition voltage	V_{FST}	V_{CC} − 4.5 LSB	V_{CC} − 2 LSB	V_{CC} + 0.5 LSB	V	
Compare time	—	0.9	—	16500	µs	4.5 V ≤ V_{CC} ≤ 5.5 V
		1.8	—	16500	µs	4.0 V ≤ V_{CC} < 4.5 V
Sampling time	—	0.6	—	∞	µs	4.5 V ≤ V_{CC} ≤ 5.5 V, with external impedance < 5.4 kΩ
		1.2	—	∞	µs	4.0 V ≤ V_{CC} < 4.5 V, with external impedance < 2.4 kΩ
Analog input current	I_{AIN}	− 0.3	—	+ 0.3	µA	
Analog input voltage	V_{AIN}	V_{SS}	—	V_{CC}	V	

(2) Notes on Using the A/D Converter

• External impedance of analog input and its sampling time

- The A/D converter has a sample and hold circuit. If the external impedance is too high to keep sufficient sampling time, the analog voltage charged to the capacitor of the internal sample and hold circuit is insufficient, adversely affecting A/D conversion precision. Therefore, to satisfy the A/D conversion precision standard, considering the relationship between the external impedance and minimum sampling time, either adjust the register value and operating frequency or decrease the external impedance so that the sampling time is longer than the minimum value. In addition, if sufficient sampling time cannot be secured, connect a capacitor of about 0.1 µF to the analog input pin.

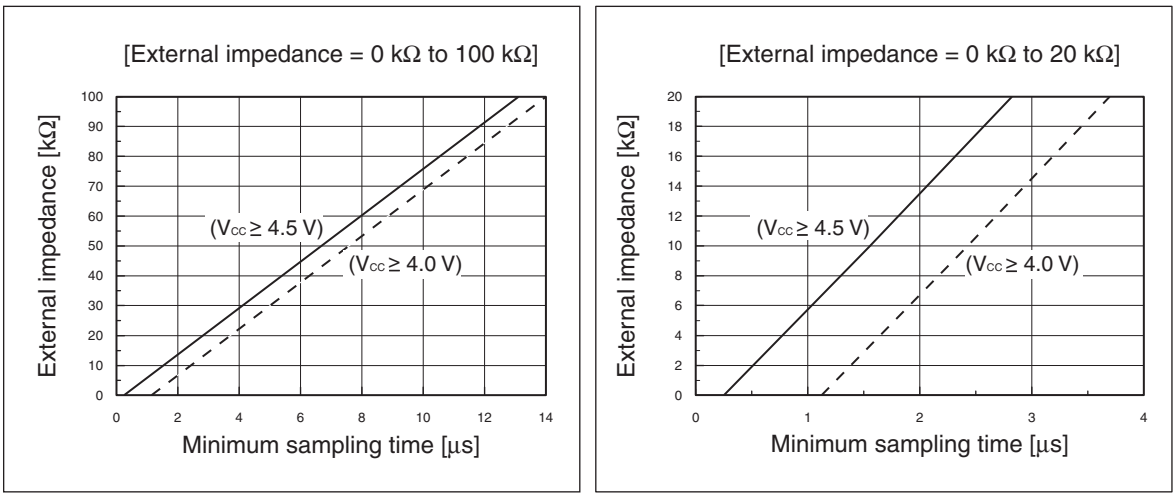
- Analog input equivalent circuit



$4.5\ V \le V_{CC} \le 5.5\ V$: $R \approx 1.95\ k\Omega$ (Max), $C \approx 17\ pF$ (Max)
$4.0\ V \le V_{CC} < 4.5\ V$: $R \approx 8.98\ k\Omega$ (Max), $C \approx 17\ pF$ (Max)

Note: The values are reference values.

- Relationship between external impedance and minimum sampling time

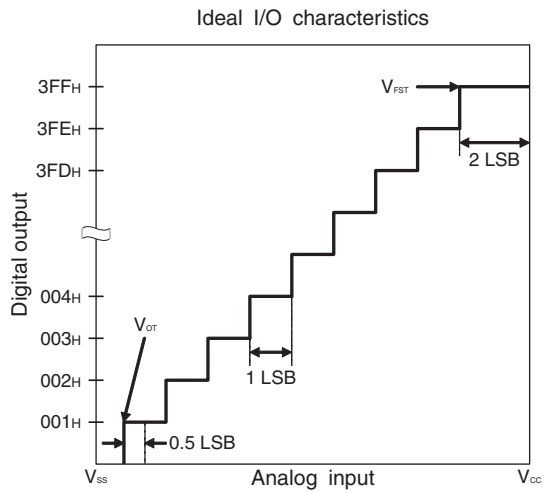


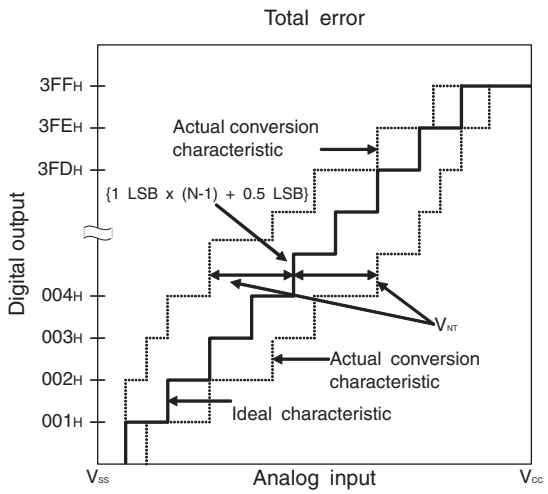
• A/D conversion error

As $|V_{CC}-V_{SS}|$ decreases, the A/D conversion error increases proportionately.

(3) Definitions of A/D Converter Terms

- Resolution
  It indicates the level of analog variation that can be distinguished by the A/D converter.
  When the number of bits is 10, analog voltage can be divided into 2^{10} = 1024.
- Linearity error (unit: LSB)
  It indicates how much an actual conversion value deviates from the straight line connecting the zero transition point (“00 0000 0000” ← → “00 0000 0001”) of a device to the full-scale transition point (“11 1111 1111” ← → “11 1111 1110”) of the same device.
- Differential linear error (unit: LSB)
  It indicates how much the input voltage required to change the output code by 1 LSB deviates from an ideal value.
- Total error (unit: LSB)
  It indicates the difference between an actual value and a theoretical value. The error can be caused by a zero transition error, a full-scale transition errors, a linearity error, a quantum error, or noise.





$$1\ \text{LSB} = \frac{V_{CC} - V_{SS}}{1024}\ (\text{V})$$

$$\text{Total error of digital output N} = \frac{V_{NT} - \{1\ \text{LSB} \times (N - 1) + 0.5\ \text{LSB}\}}{1\ \text{LSB}}\ [\text{LSB}]$$

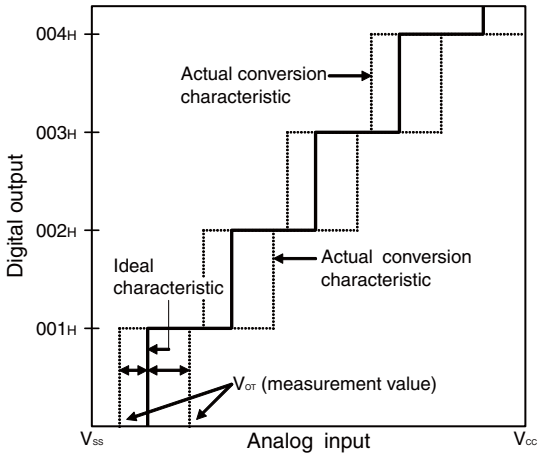
N : A/D converter digital output value

V_{NT}: Voltage at which the digital output transits from $(N - 1)_H$ to N_H

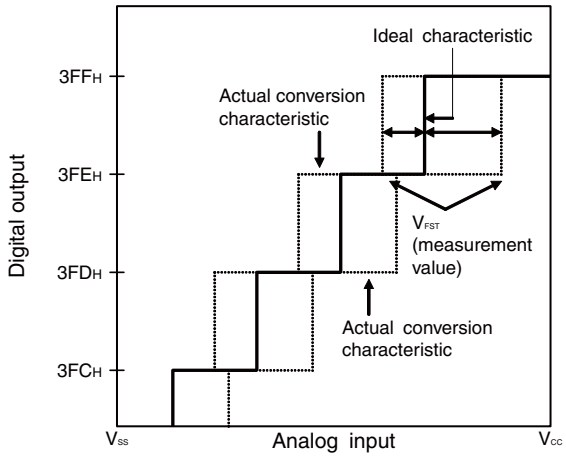
(Continued)

(Continued)

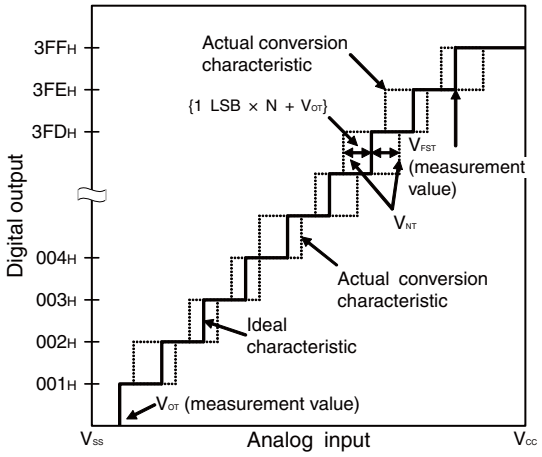
Zero transition error



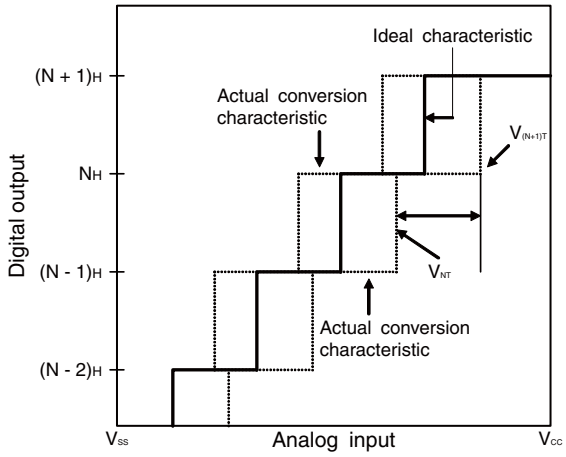
Full-scale transition error



Linearity error



Differential linearity error



$$\text{Linearity error of digital output N} = \frac{V_{NT} - \{1\ \text{LSB} \times N + V_{OT}\}}{1\ \text{LSB}}$$

$$\text{Differential linear error of digital output N} = \frac{V_{(N+1)T} - V_{NT}}{1\ \text{LSB}} - 1$$

N : A/D converter digital output value

V_{NT}: Voltage at which the digital output transits from $(N - 1)_H$ to N_H

V_{OT} (ideal value) = V_{SS} + 0.5 LSB [V]

V_{FST} (ideal value) = V_{CC} - 2 LSB [V]

6. Flash Memory Write/Erase Characteristics

Parameter	Value			Unit	Remarks
	Min	Typ	Max		
Sector erase time (2 Kbytes sector)	—	0.2*1	0.5*2	s	The time of writing 00H prior to erasure is excluded.
Sector erase time (16 Kbytes sector)	—	0.5*1	7.5*2	s	The time of writing 00H prior to erasure is excluded.
Byte writing time	—	21	6100*2	µs	System-level overhead is excluded.
Erase / write cycle	100000	—	—	cycle	
Power supply voltage at erase/ write	3.0	—	5.5	V	
Flash memory data retention time	20*3	—	—	year	Average T_A = + 85°C

*1: T_A = + 25 °C, V_{CC} = 5.0 V, 100000 cycles

*2: T_A = + 85 °C, V_{CC} = 3.0 V, 100000 cycles

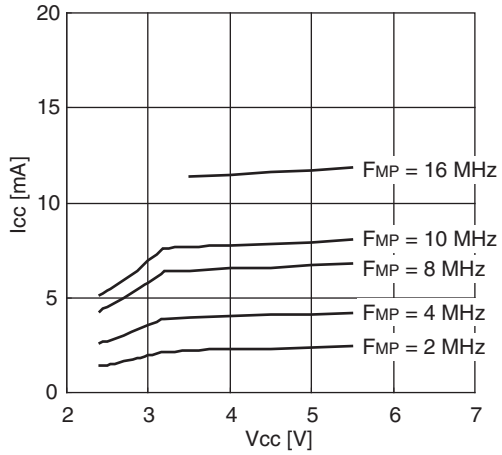
*3: This value is converted from the result of a technology reliability assessment. (The value is converted from the result of a high temperature accelerated test using the Arrhenius equation with the average temperature being + 85°C) .

■ EXAMPLE CHARACTERISTICS

- **Power supply current temperature**

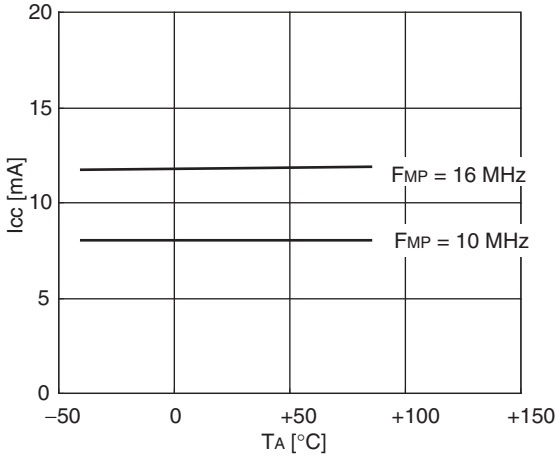
Icc – Vcc

T_A = + 25 °C F_{MP} = 2, 4, 8, 10, 16 MHz (divided by 2)
Main clock mode with external clock operating



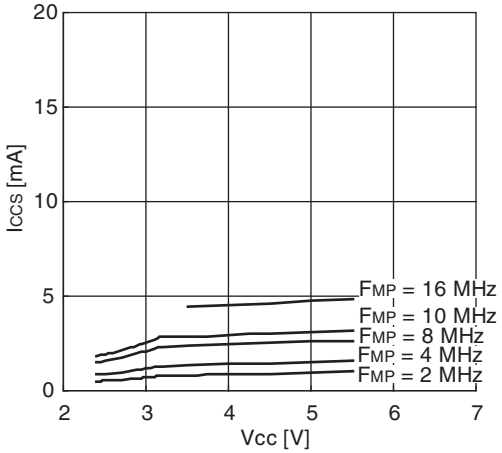
Icc – T_A

Vcc = 5.5 V F_{MP} = 10, 16 MHz (divided by 2)
Main clock mode with external clock operating



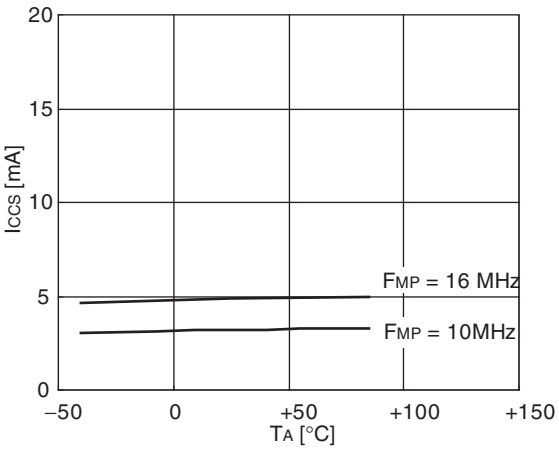
Iccs – Vcc

T_A = + 25 °C F_{MP} = 2, 4, 8, 10, 16 MHz (divided by 2)
Main sleep mode with the external clock operating



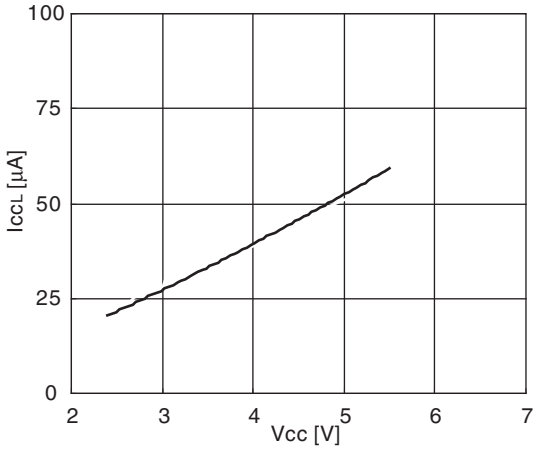
Iccs – T_A

Vcc = 5.5 V F_{MP} = 10, 16 MHz (divided by 2)
Main sleep mode with the external clock operating



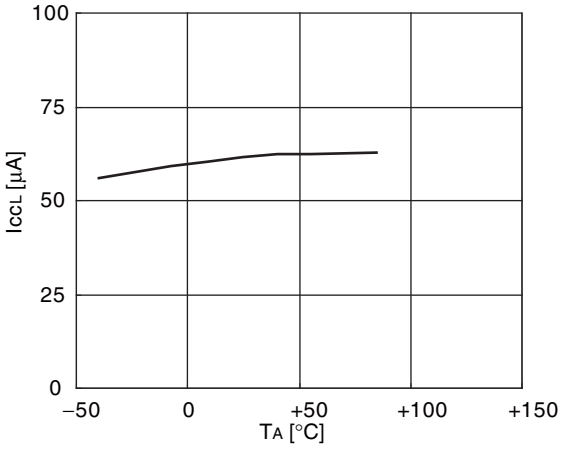
I_{CCL} – Vcc

T_A = + 25 °C F_{MPL} = 16 kHz (divided by 2)
Subclock mode with the external clock operating



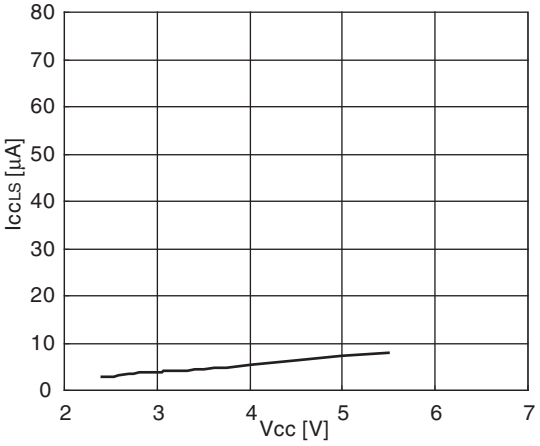
I_{CCL} – T_A

Vcc = 5.5 V F_{MPL} = 16 kHz (divided by 2)
Subclock mode with the external clock operating

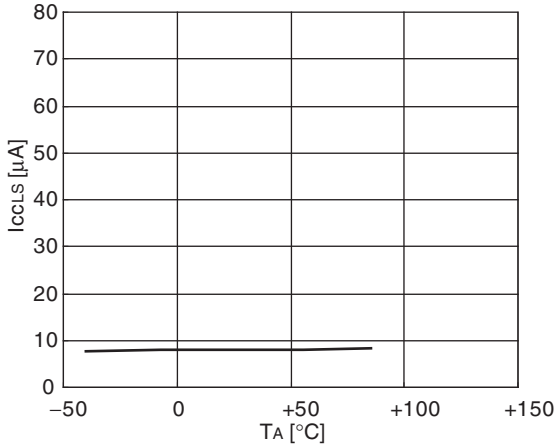


(Continued)

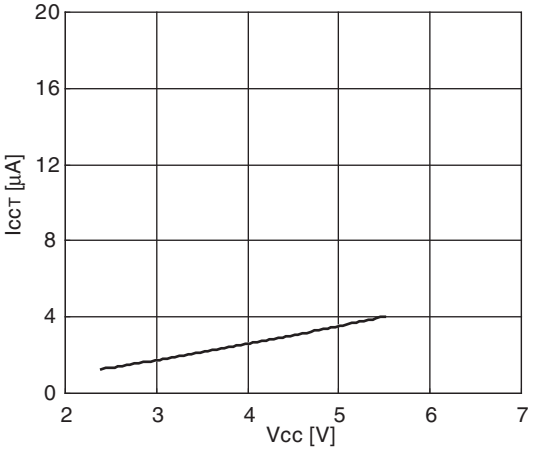
I_{CCLS} – Vcc
T_A = + 25 °C F_{MPL} = 16 kHz (divided by 2)
Subsleep mode with external clock operating



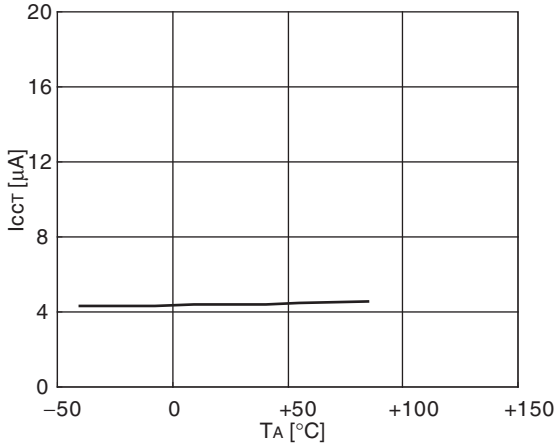
I_{CCLS} – T_A
Vcc = 5.5 V F_{MPL} = 16 kHz (divided by 2)
Subsleep mode with external clock operating



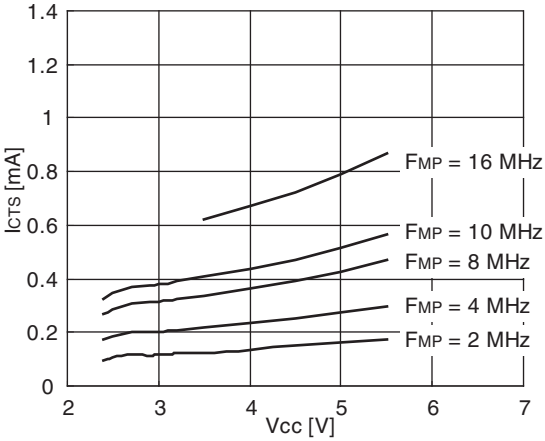
I_{CCT} – Vcc
T_A = + 25 °C F_{MPL} = 16 kHz (divided by 2)
Watch mode with external clock operating



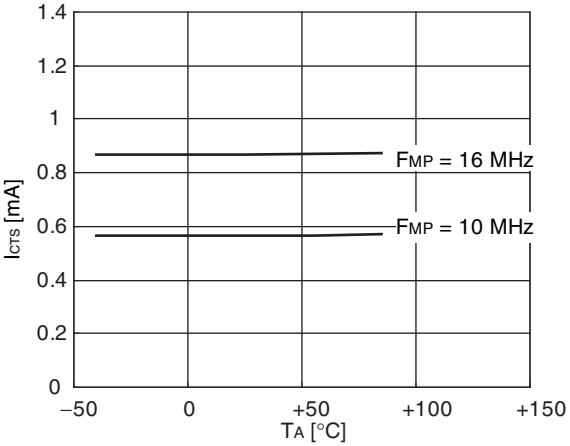
I_{CCT} – T_A
Vcc = 5.5 V F_{MPL} = 16 kHz (divided by 2)
Watch mode with external clock operating



I_{CTS} – Vcc
T_A = + 25 °C F_{MP} = 2, 4, 8, 10, 16 MHz (divided by 2)
Timebase timer mode with external clock operating



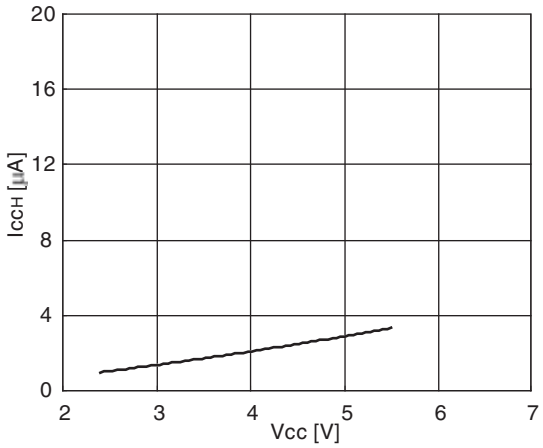
I_{CTS} – T_A
Vcc = 5.5 V F_{MP} = 10, 16 MHz (divided by 2)
Timebase timer mode with external clock operating



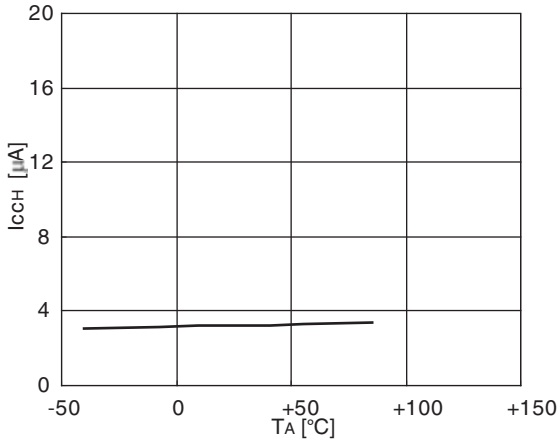
(Continued)

(Continued)

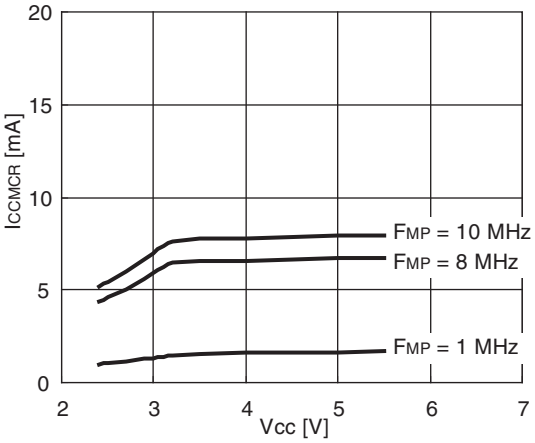
I_{CCH} – Vcc
T_A = + 25 °C F_{MPL} = (stop)
Substop mode with the external clock stopping



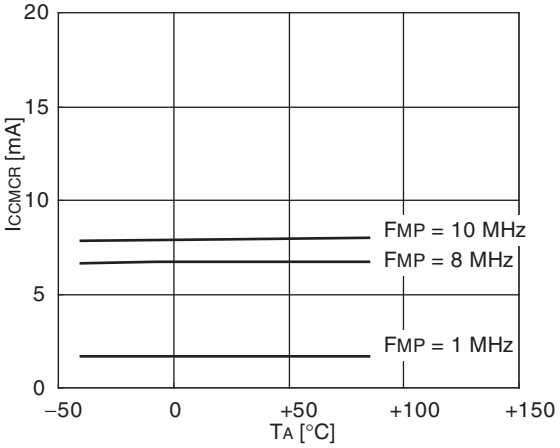
I_{CCH} – T_A
Vcc = 5.5 V F_{MPL} = (stop)
Substop mode with the external clock stopping



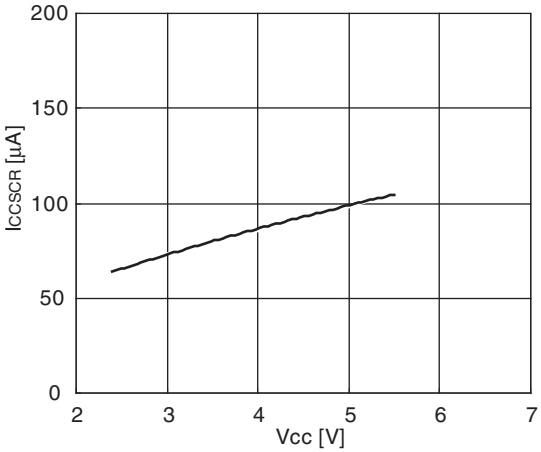
I_{CCMCR} – Vcc
T_A = + 25 °C F_{MP} = 1, 8, 10 MHz (no division)
Main clock mode
with the internal main CR clock operating



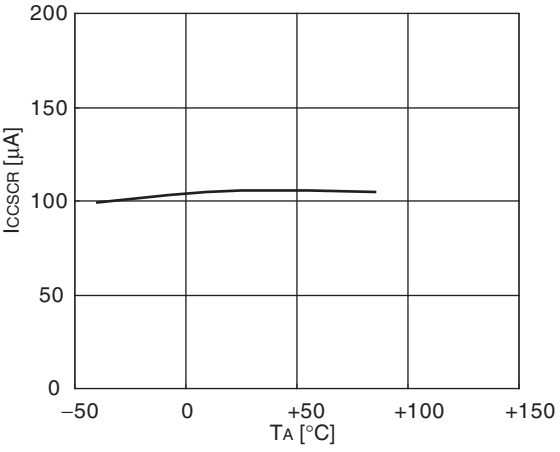
I_{CCMCR} – T_A
Vcc = 5.5 V F_{MP} = 1, 8, 10 MHz (no division)
Main clock mode
with the internal main CR clock operating



I_{CCSCR} – Vcc
T_A = + 25 °C F_{MPL} = 50 kHz (divided by 2)
Sub clock mode with
internal sub CR clock operating

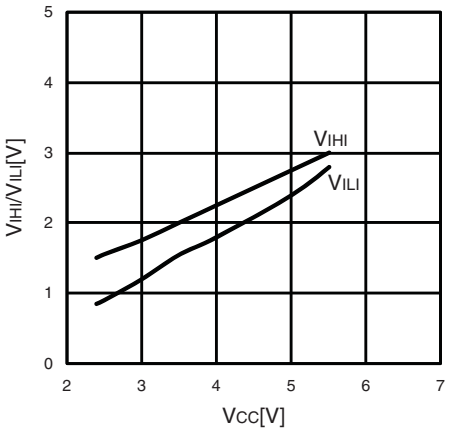


I_{CCSCR} – T_A
Vcc = 5.5 V F_{MPL} = 50 kHz (divided by 2)
Sub clock mode with
internal sub CR clock operating

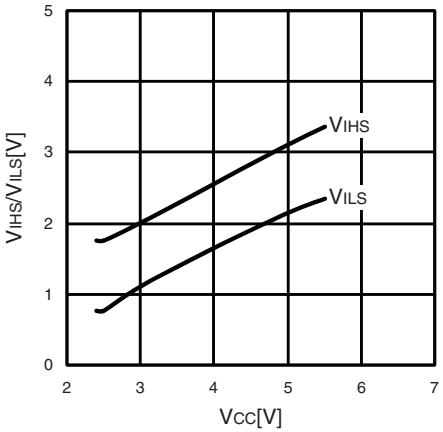


- **Input voltage**

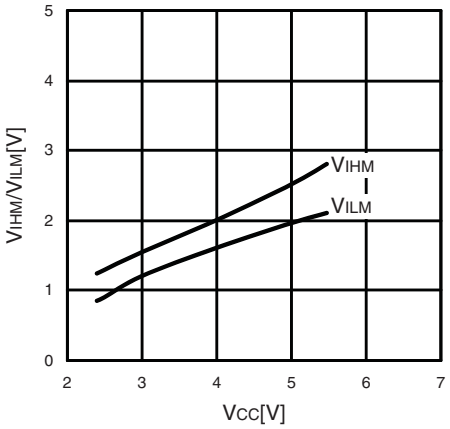
V_{IHI} - V_{CC} and V_{ILI} - V_{CC}
T_A=+25°C



V_{IHS} - V_{CC} and V_{ILS} - V_{CC}
T_A=+25°C

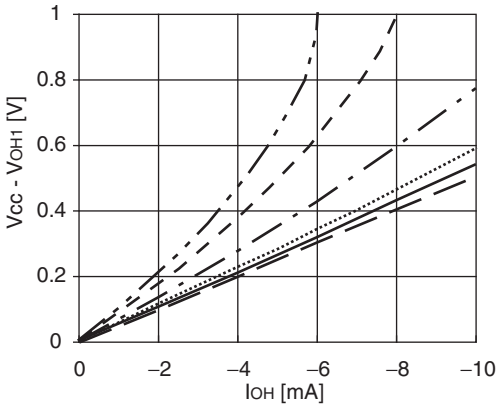


V_{IHM} - V_{CC} and V_{ILM} - V_{CC}
T_A=+25°C



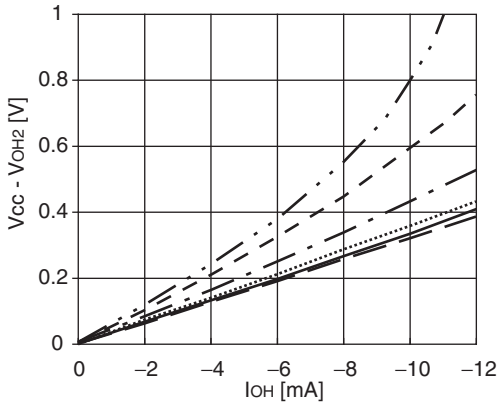
- **Output voltage**

$(V_{CC} - V_{OH1}) - I_{OH}$
$T_A = +25\ °C$



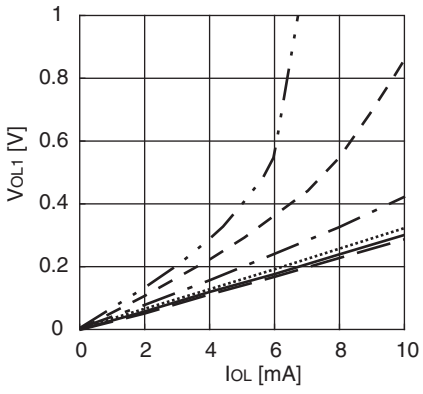
Vcc = 2.4 V
Vcc = 2.7 V
Vcc = 3.5 V
Vcc = 4.5 V
Vcc = 5.0 V
Vcc = 5.5 V

$(V_{CC} - V_{OH2}) - I_{OH}$
$T_A = +25\ °C$



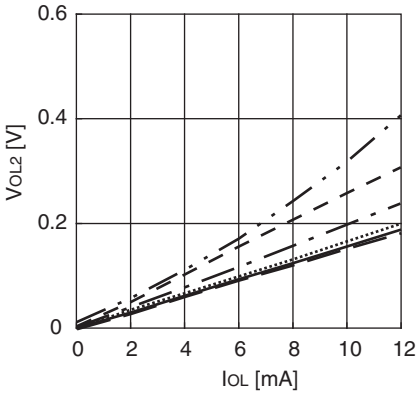
Vcc = 2.4 V
Vcc = 2.7 V
Vcc = 3.5 V
Vcc = 4.5 V
Vcc = 5.0 V
Vcc = 5.5 V

$V_{OL1} - I_{OL}$
$T_A = +25\ °C$



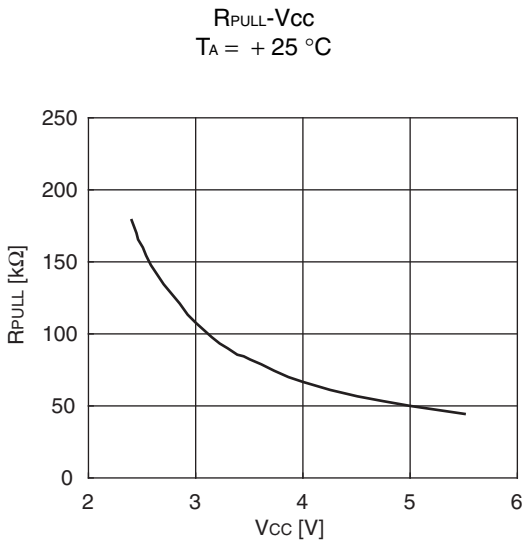
Vcc = 2.4 V
Vcc = 2.7 V
Vcc = 3.5 V
Vcc = 4.5 V
Vcc = 5.0 V
Vcc = 5.5 V

$V_{OL2} - I_{OL}$
$T_A = +25\ °C$



Vcc = 2.4 V
Vcc = 2.7 V
Vcc = 3.5 V
Vcc = 4.5 V
Vcc = 5.0 V
Vcc = 5.5 V

- **Pull-up**



■ MASK OPTIONS

No.	Part Number	MB95F262H MB95F263H MB95F264H MB95F272H MB95F273H MB95F274H MB95F282H MB95F283H MB95F284H	MB95F262K MB95F263K MB95F264K MB95F272K MB95F273K MB95F274K MB95F282K MB95F283K MB95F284K
	Selectable/Fixed	Fixed	
1	Low-voltage detection reset	Without low-voltage detection reset	With low-voltage detection reset
2	Reset	With dedicated reset input	Without dedicated reset input

■ ORDERING INFORMATION

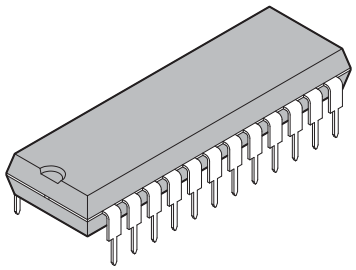
Part Number	Package
MB95F262HWQN-G-SNE1 MB95F262HWQN-G-SNERE1 MB95F262KWQN-G-SNE1 MB95F262KWQN-G-SNERE1 MB95F263HWQN-G-SNE1 MB95F263HWQN-G-SNERE1 MB95F263KWQN-G-SNE1 MB95F263KWQN-G-SNERE1 MB95F264HWQN-G-SNE1 MB95F264HWQN-G-SNERE1 MB95F264KWQN-G-SNE1 MB95F264KWQN-G-SNERE1	32-pin plastic QFN (LCC-32P-M19)
MB95F262HP-G-SH-SNE2 MB95F262KP-G-SH-SNE2 MB95F263HP-G-SH-SNE2 MB95F263KP-G-SH-SNE2 MB95F264HP-G-SH-SNE2 MB95F264KP-G-SH-SNE2	24-pin plastic SDIP (DIP-24P-M07)
MB95F262HPF-G-SNE2 MB95F262KPF-G-SNE2 MB95F263HPF-G-SNE2 MB95F263KPF-G-SNE2 MB95F264HPF-G-SNE2 MB95F264KPF-G-SNE2	20-pin plastic SOP (FPT-20P-M09)
MB95F262HPFT-G-SNE2 MB95F262KPFT-G-SNE2 MB95F263HPFT-G-SNE2 MB95F263KPFT-G-SNE2 MB95F264HPFT-G-SNE2 MB95F264KPFT-G-SNE2	20-pin plastic TSSOP (FPT-20P-M10)
MB95F282HWQN-G-SNE1 MB95F282HWQN-G-SNERE1 MB95F282KWQN-G-SNE1 MB95F282KWQN-G-SNERE1 MB95F283HWQN-G-SNE1 MB95F283HWQN-G-SNERE1 MB95F283KWQN-G-SNE1 MB95F283KWQN-G-SNERE1 MB95F284HWQN-G-SNE1 MB95F284HWQN-G-SNERE1 MB95F284KWQN-G-SNE1 MB95F284KWQN-G-SNERE1	32-pin plastic QFN (LCC-32P-M19)
MB95F282HPH-G-SNE2 MB95F282KPH-G-SNE2 MB95F283HPH-G-SNE2 MB95F283KPH-G-SNE2 MB95F284HPH-G-SNE2 MB95F284KPH-G-SNE2	16-pin plastic DIP (DIP-16P-M06)

(Continued)

(Continued)

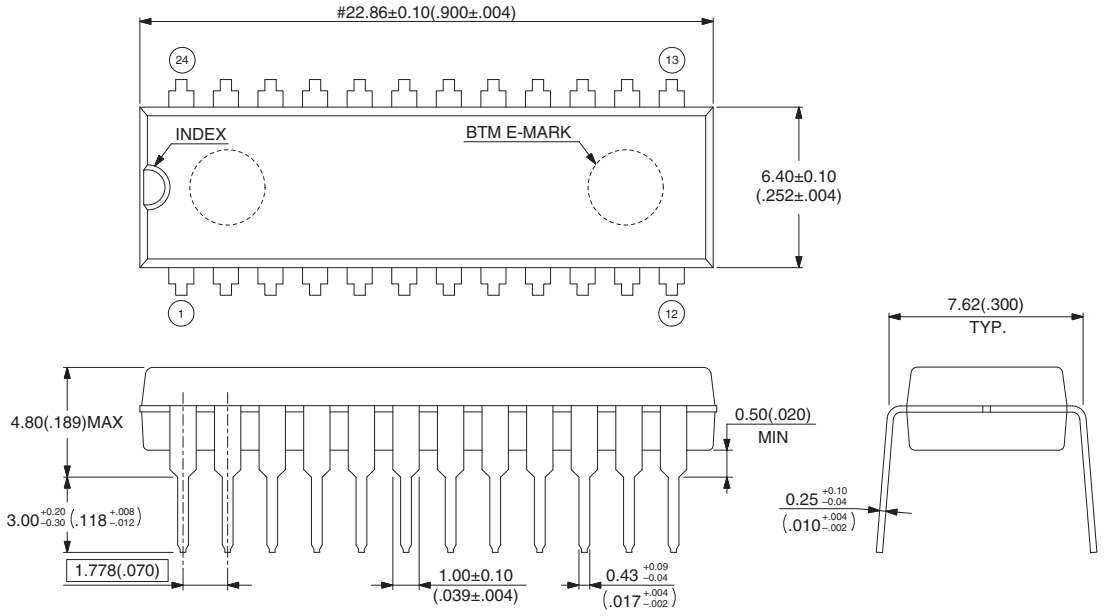
Part Number	Package
MB95F282HPF-G-SNE1 MB95F282KPF-G-SNE1 MB95F283HPF-G-SNE1 MB95F283KPF-G-SNE1 MB95F284HPF-G-SNE1 MB95F284KPF-G-SNE1	16-pin plastic SOP (FPT-16P-M06)
MB95F272HPH-G-SNE2 MB95F272KPH-G-SNE2 MB95F273HPH-G-SNE2 MB95F273KPH-G-SNE2 MB95F274HPH-G-SNE2 MB95F274KPH-G-SNE2	8-pin plastic DIP (DIP-8P-M03)
MB95F272HPF-G-SNE2 MB95F272KPF-G-SNE2 MB95F273HPF-G-SNE2 MB95F273KPF-G-SNE2 MB95F274HPF-G-SNE2 MB95F274KPF-G-SNE2	8-pin plastic SOP (FPT-8P-M08)

■ PACKAGE DIMENSIONS

24-pin plastic SDIP		
 (DIP-24P-M07)	Lead pitch	1.778 mm
	Package width × package length	6.40 mm × 22.86 mm
	Sealing method	Plastic mold
	Mounting height	4.80 mm Max

24-pin plastic SDIP
(DIP-24P-M07)

Note 1) Pins width and pins thickness include plating thickness.
Note 2) Pins width do not include tie bar cutting remainder.
Note 3) # : These dimensions do not include resin protrusion.



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

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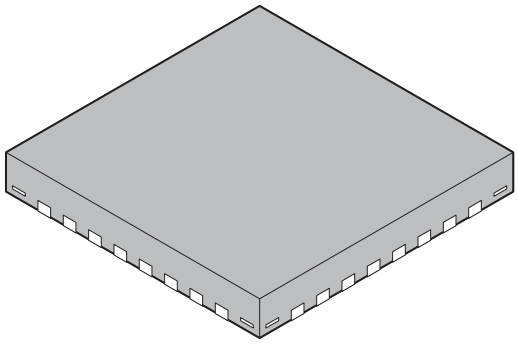
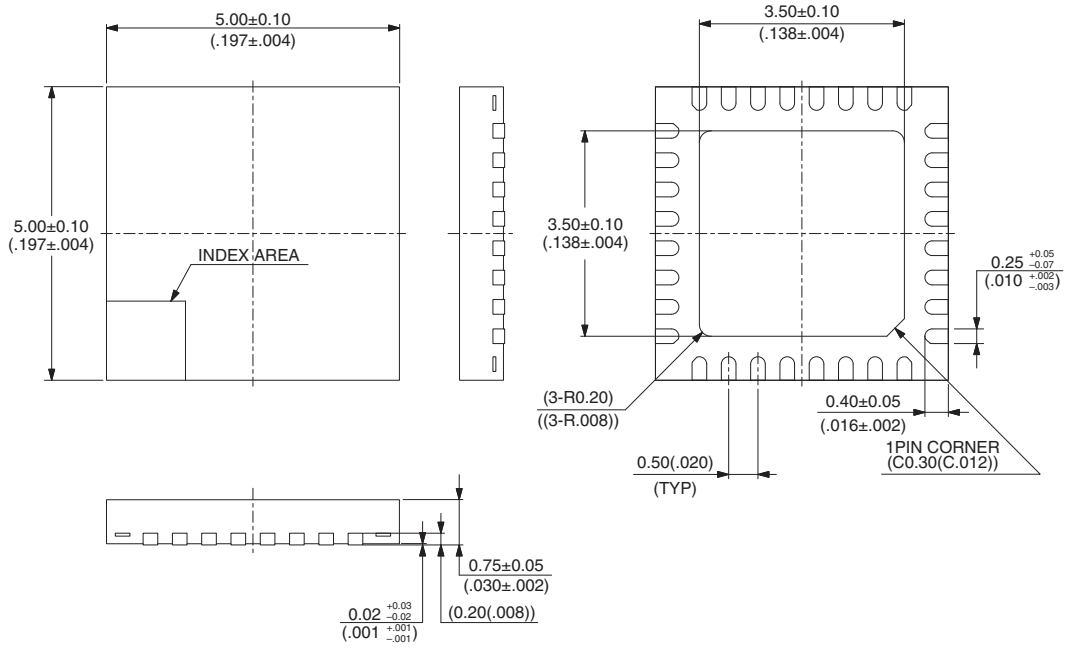
Please check the latest Package dimension at the following URL.
http://edevice.fujitsu.com/package/en-search/

(Continued)

32-pin plastic QFN		
	Lead pitch	0.50 mm
	Package width × package length	5.00 mm × 5.00 mm
	Sealing method	Plastic mold
	Mounting height	0.80 mm MAX
	Weight	0.06 g
(LCC-32P-M19)		

32-pin plastic QFN
(LCC-32P-M19)



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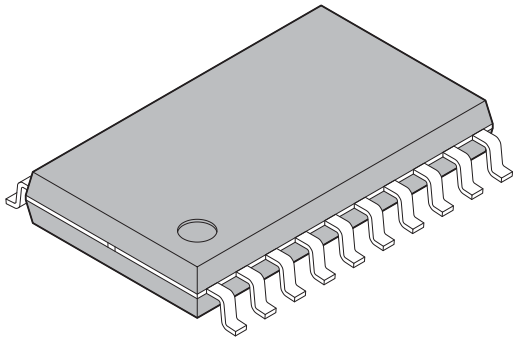
Dimensions in mm (inches).
Note: The values in parentheses are reference values.

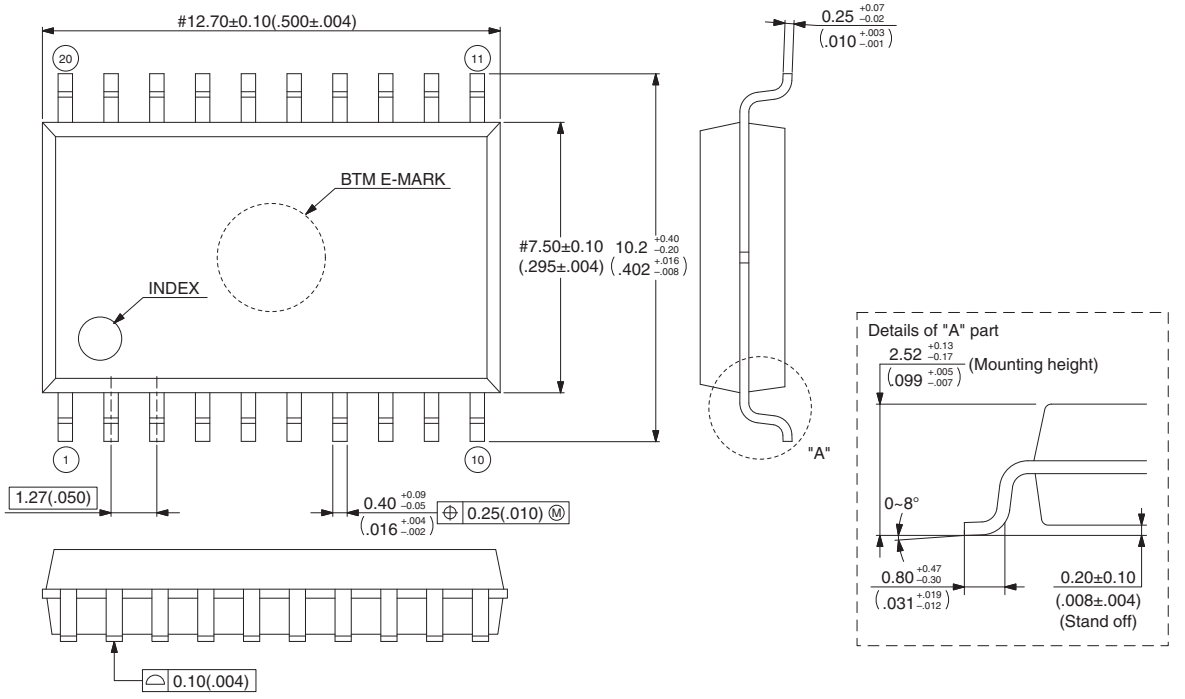
Please check the latest Package dimension at the following URL.
http://edevice.fujitsu.com/package/en-search/

(Continued)

20-pin plastic SOP		
	Lead pitch	1.27 mm
	Package width × package length	7.50 mm × 12.70 mm
	Lead shape	Gullwing
	Lead bend direction	Normal bend
	Sealing method	Plastic mold
	Mounting height	2.65 mm Max
(FPT-20P-M09)		

20-pin plastic SOP
(FPT-20P-M09)

Note 1) Pins width and pins thickness include plating thickness.
Note 2) Pins width do not include tie bar cutting remainder.
Note 3) # : These dimensions do not include resin protrusion.



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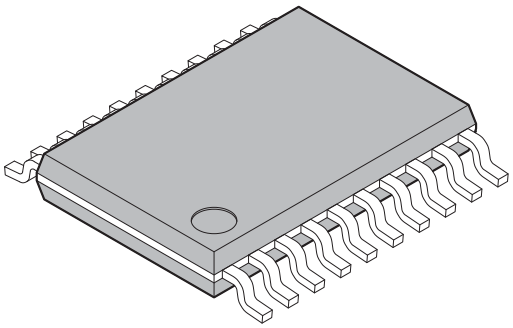
Dimensions in mm (inches).
Note: The values in parentheses are reference values.

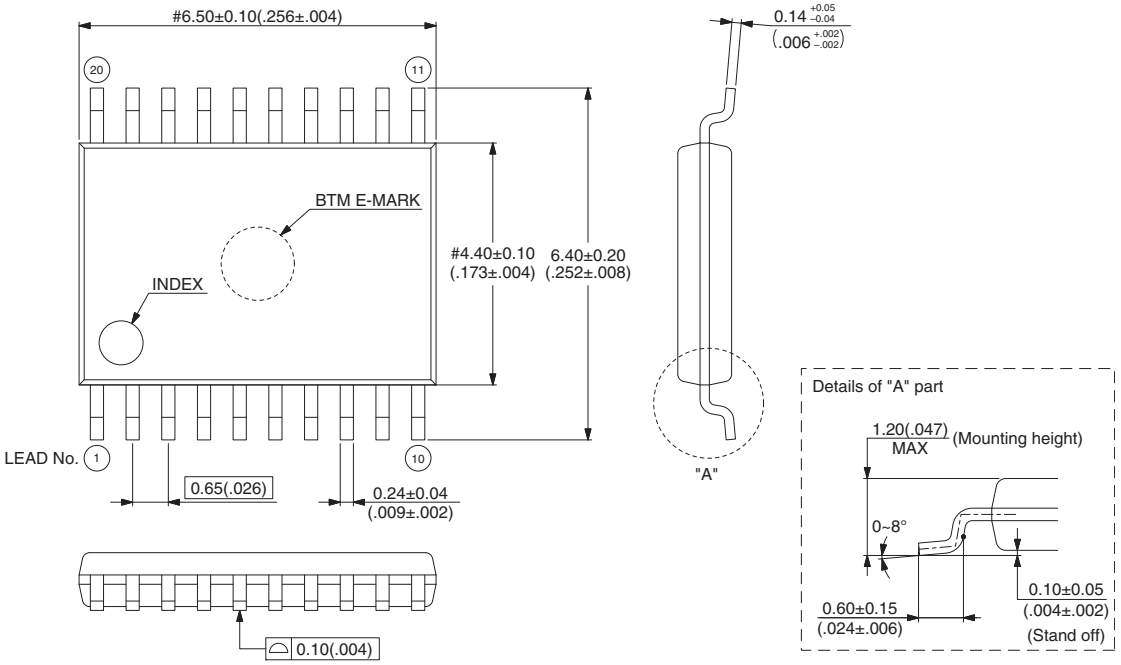
Please check the latest Package dimension at the following URL.
http://edevice.fujitsu.com/package/en-search/

(Continued)

20-pin plastic TSSOP		
	Lead pitch	0.65 mm
	Package width × package length	4.40 mm × 6.50 mm
	Lead shape	Gullwing
	Sealing method	Plastic mold
	Mounting height	1.20 mm MAX
	Weight	0.08 g
(FPT-20P-M10)		

20-pin plastic TSSOP
(FPT-20P-M10)

Note 1) Pins width and pins thickness include plating thickness.
Note 2) Pins width do not include tie bar cutting remainder.
Note 3) # : These dimensions do not include resin protrusion.



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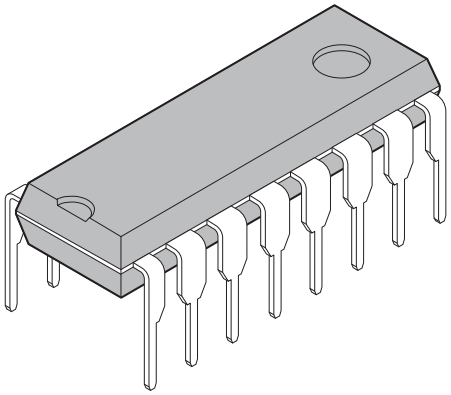
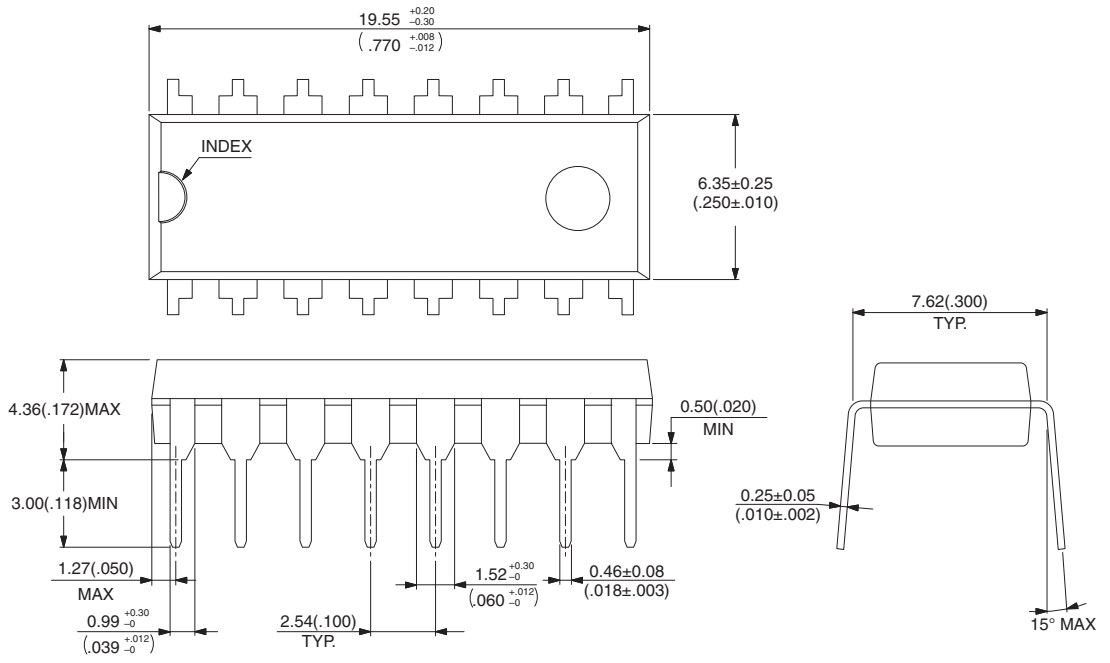
Dimensions in mm (inches).
Note: The values in parentheses are reference values.

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

(Continued)

16-pin plastic DIP	Lead pitch	2.54 mm
	Sealing method	Plastic mold
(DIP-16P-M06)		

16-pin plastic DIP
(DIP-16P-M06)



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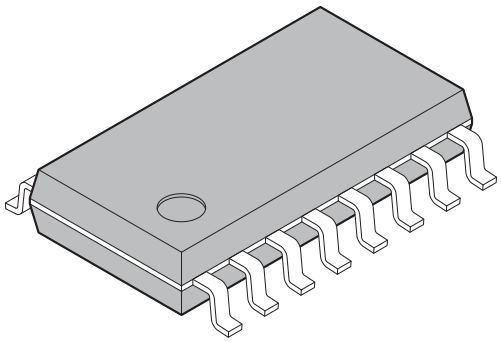
Dimensions in mm (inches).
Note: The values in parentheses are reference values

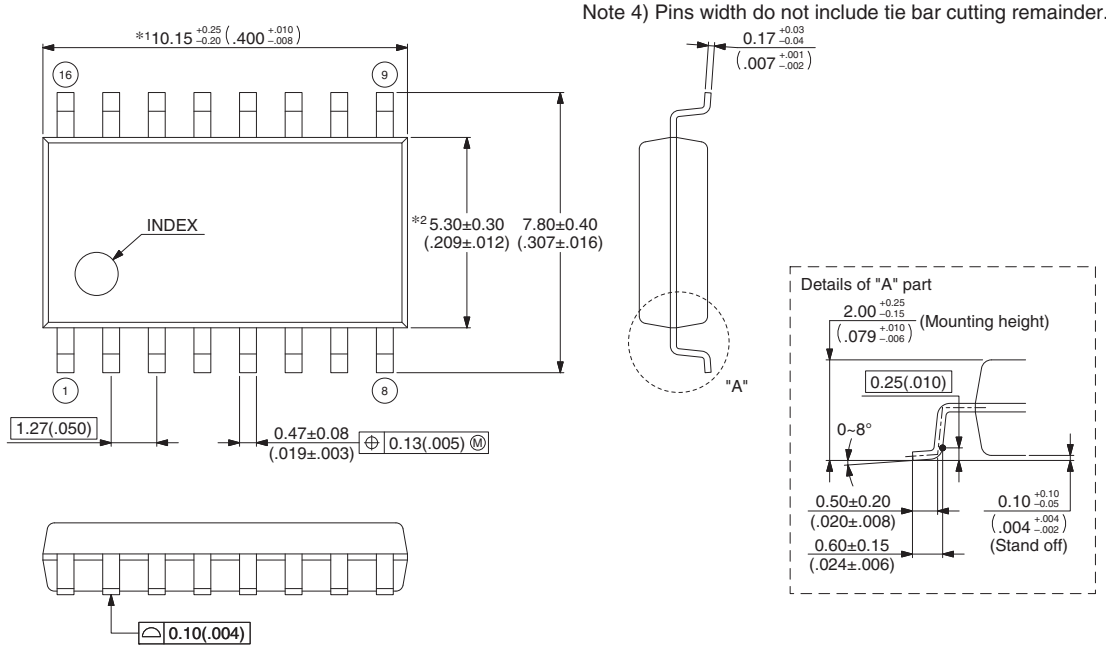
Please check the latest Package dimension at the following URL.
http://edevice.fujitsu.com/package/en-search/

(Continued)

16-pin plastic SOP		
	Lead pitch	1.27 mm
	Package width × package length	5.3 × 10.15 mm
	Lead shape	Gullwing
	Sealing method	Plastic mold
	Mounting height	2.25 mm MAX
	Weight	0.20 g
(FPT-16P-M06)	Code (Reference)	P-SOP16-5.3×10.15-1.27

16-pin plastic SOP
(FPT-16P-M06)

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.



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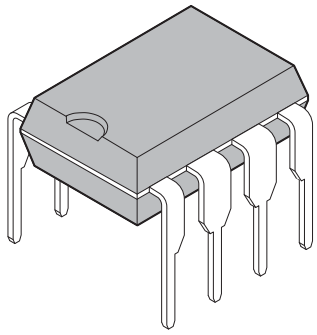
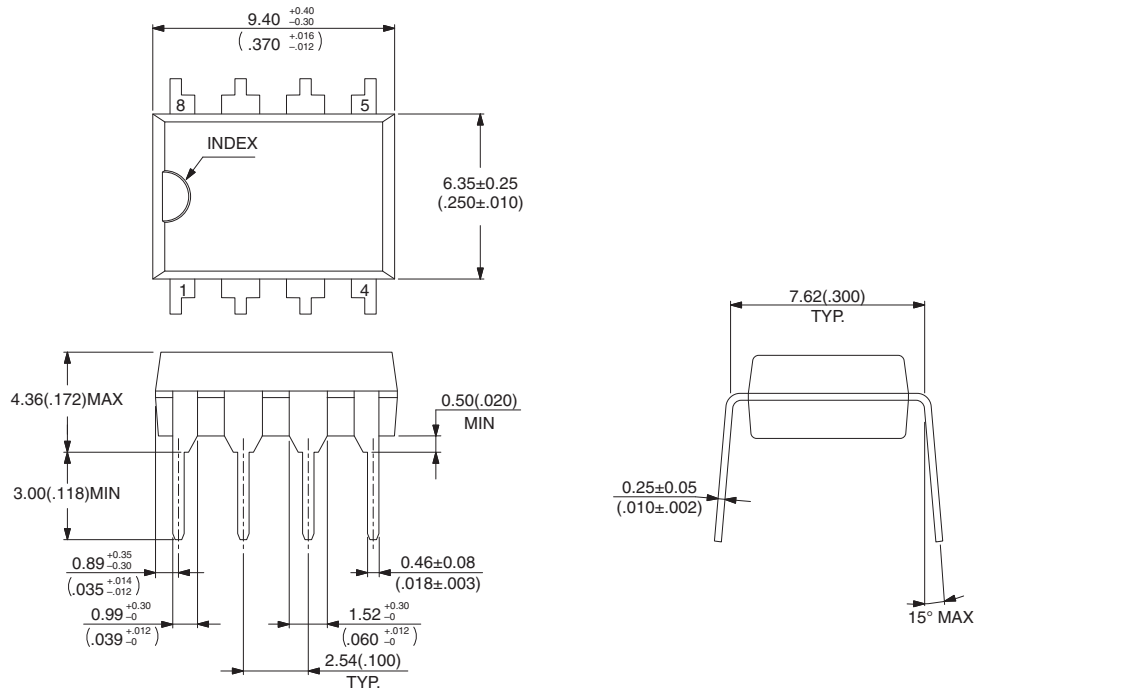
Dimensions in mm (inches).
Note: The values in parentheses are reference values.

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

(Continued)

8-pin plastic DIP	Lead pitch	2.54 mm
	Sealing method	Plastic mold
(DIP-8P-M03)		

8-pin plastic DIP
(DIP-8P-M03)



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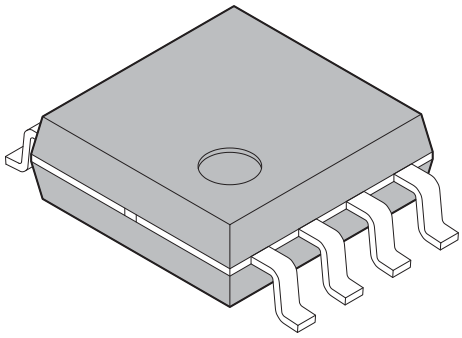
Dimensions in mm (inches).
Note: The values in parentheses are reference values

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

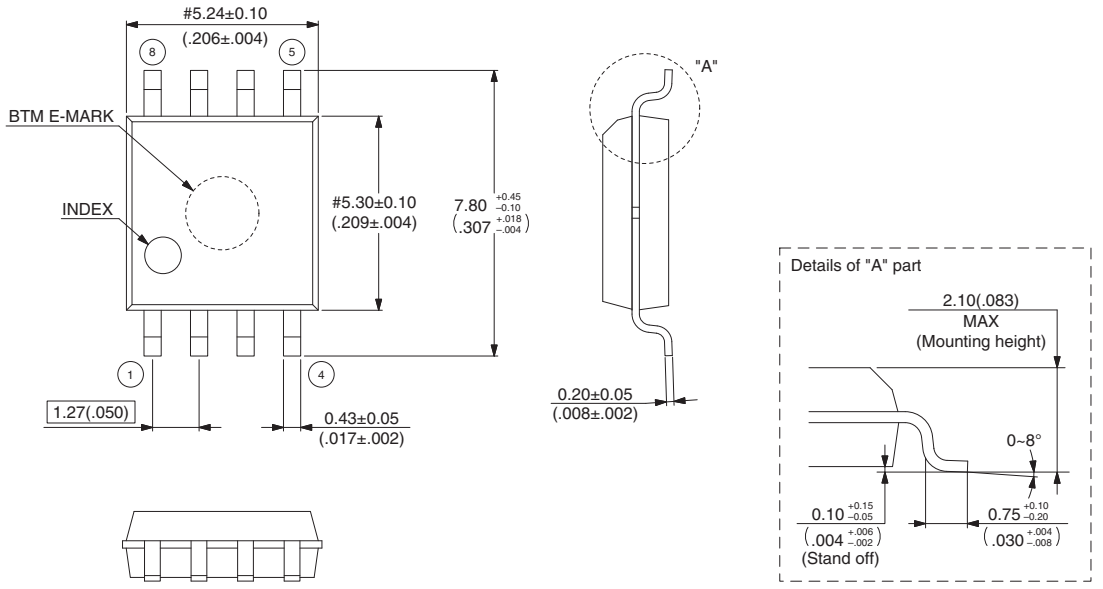
(Continued)

(Continued)

8-pin plastic SOP		
	Lead pitch	1.27 mm
	Package width × package length	5.30 mm × 5.24 mm
	Lead shape	Gullwing
	Lead bend direction	Normal bend
	Sealing method	Plastic mold
	Mounting height	2.10 mm Max
(FPT-8P-M08)		

8-pin plastic SOP
(FPT-8P-M08)

Note 1) Pins width and pins thickness include plating thickness.
Note 2) Pins width do not include tie bar cutting remainder.
Note 3) # : These dimensions do not include resin protrusion.



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

Please check the latest Package dimension at the following URL.
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■ MAIN CHANGES IN THIS EDITION

Page	Section	Change Results
5	■ PRODUCT LINE-UP • MB95270H Series	Corrected the Flash memory is as follows. Number of write/erase cycles (Min): 100000→ Number of write/erase cycles: 100000
7	• MB95280H Series	
66	■ ELECTRICAL CHARACTERISTICS 4. AC Characteristics (7) Low-voltage Detection	Corrected “Power supply voltage change time (at power supply rise)”. Deleted the sentences for remark on “Slope of power supply that the reset release signal generates”. Value (Min) : “—”→3000 Value (Typ) : 3000→“—” Corrected “Power supply voltage change time (at power supply fall)”. Deleted the sentences for remark on “Slope of power supply that the reset detection signal generates”. Value (Min) : “—”→300 Value (Typ) : 300→“—”
71	■ ELECTRICAL CHARACTERISTICS 6. Flash Memory Write/Erase Characteristics	Corrected the values of “Erase / write cycle”. Min : “—”→100000 Typ : 100000→“—”
79	■ ORDERING INFORMATION	Corrected the part number for “32-pin plastic QFN (LCC-32P-M19)”. Added the following part numbers; MB95F262HWQN-G-SNERE1 MB95F262KWQN-G-SNERE1 MB95F263HWQN-G-SNERE1 MB95F263KWQN-G-SNERE1 MB95F264HWQN-G-SNERE1 MB95F264KWQN-G-SNERE1 MB95F282HWQN-G-SNERE1 MB95F282KWQN-G-SNERE1 MB95F283HWQN-G-SNERE1 MB95F283KWQN-G-SNERE1 MB95F284HWQN-G-SNERE1 MB95F284KWQN-G-SNERE1

The vertical lines drawn on the left side of the page indicate the changes.

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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 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
http://cn.fujitsu.com/fmc/en/

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