

8-bit Proprietary Microcontrollers

CMOS

F²MC-8L MB89210 Series

MB89215/F217/P215/PV210

DESCRIPTION

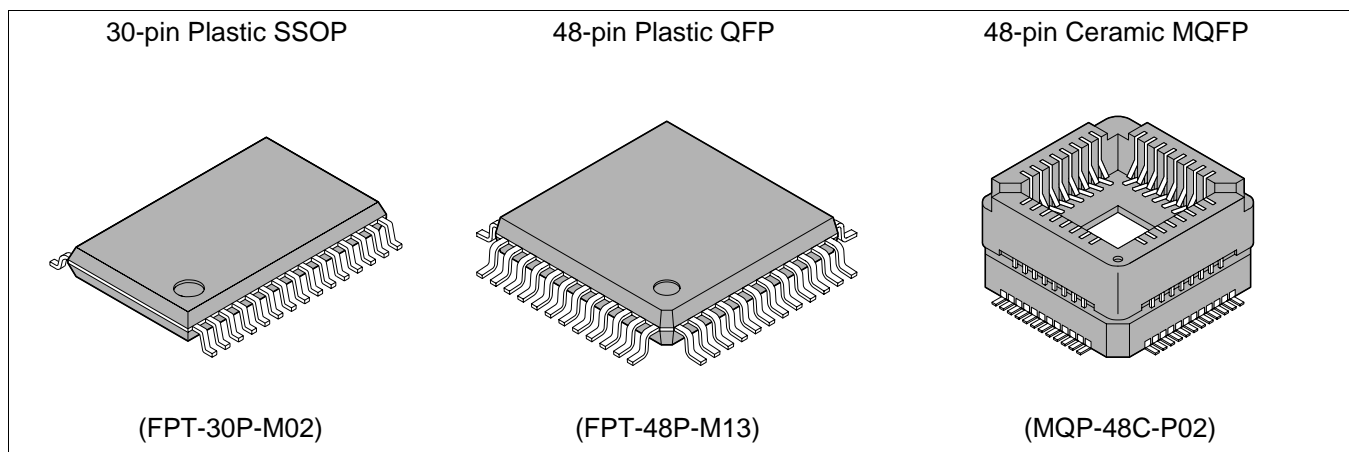
The MB89210 series is a one-chip microcontroller that features a compact instruction set and contains a range of peripheral functions including timers, a serial interface, A/D converters and external interrupts.

FEATURES

- F²MC-8L CPU core
- Maximum memory spaces : 64 Kbytes
- Minimum instruction execution time : 0.32 μ s to 5.12 μ s (at 12.5 MHz)
- Interrupt processing time : 2.88 μ s to 46.08 μ s (at 12.5 MHz)
- I/O port : Max 22
- 21-bit time base timer
- 8-bit PWM timer
- 8-/16-bit capture timer/counter : 2 ch
- Watchdog timer
- 12-bit PPG timer

(Continued)

PACKAGE



MB89210 Series

(Continued)

- 10-bit A/D converter : 8 ch
- LIN-UART
- 8-bit serial I/O
- External Interrupt : 3 ch
- External or CR (built-in) oscillation clock, switchable
- Low power consumption modes (stop modes, sleep modes)
- Package : SSOP-30, QFP-48, MQFP-48
- CMOS technology

MB89210 Series

■ PRODUCT LINEUP

Part number		MB89215	MB89F217	MB89P215	MB89PV210
Parameter					
Type		For mass products (Mask ROM product)	Flash products (Flash ROM product)	One-time product (for small-scale production)	Piggy back/ Evaluation product (for development)
ROM capacity		16 Kbyte (Built-in ROM)	32 Kbyte (Built-in Flash memory)	16 Kbyte (Built-in PROM)	32 Kbyte (External EPROM)
RAM capacity		512 byte	1 Kbyte	512 byte	2 Kbyte
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 : 0.32 μ s to 5.12 μ s (at 12.5 MHz) Interruption processing time : 2.88 μ s to 46.08 μ s (at 12.5 MHz)			
Peripheral functions	Ports	General purpose I/O port \times 21 (also usable as resources) General purpose input port \times 1			
	21-bit time base timer	21 bits Interrupt cycle : at 10 MHz (0.82 ms, 3.3 ms, 26.2 ms, 419.4 ms)			
	Watchdog timer	Reset generation cycle : at 10 MHz (Min 419.4 ms)			
	8-bit PWM timer	8-bit interval timer operation (supports square wave output, operating clock period : 0.4 μ s to 25.6 μ s) 8-bit resolution PWM operation (conversion period : 102.4 μ s to 26.84 μ s)			
	8/16-bit capture timer counter	8-bit capture timer/counter \times 1 channel + 8-bit timer or 16-bit capture timer/counter \times 1 channel Capable of event count operation and square wave output using external clock input with 8-bit timer 0 or 16-bit counter			
	LIN-UART	Full duplex, Synchronous/asynchronous transfer (with start/stop bit), Capable of setting over 30,000 different baud rates using a 15-bit reload counter Support for the LIN protocol, slave nodes, and LIN synch break/synch field detection			
	8-bit serial I/O	8-bit length, Selectable LSB first or MSB first Transfer clock (0.8 μ s external, 0.8 μ s, 3.2 μ s, 12.8 μ s internal)			
	12-bit PPG timer	Output frequency : Selectable pulse width and cycle (Cycle : 1.6 μ s to 419.3 ms)			
	External interrupt circuit	3-channel (interrupt vector, request flag, request output acceptance) Edge selectable (selectable rising, falling or both edge) Can be used for recovery from stop or sleep mode (edge detection also available in stop mode).			
	A/D converter	10-bit accuracy \times 8-channel A/D conversion function (conversion time : 15.2 μ s/10 MHz) Continuous activation by an 8-/16-bit timer/counter output or time base timer output capable.			
Standby mode		Sleep mode and Stop mode			
Operating voltage *		3.5 V to 5.5 V	3.5 V to 5.5 V	3.5 V to 5.5 V	3.5 V to 5.5 V
CR(built-in) oscillator		Yes	Yes	Yes	No

* : The minimum operating voltage varies with the operating frequency, the function and the connected ICE.

Note : Unless otherwise stated, clock periods and conversion times are for 10 MHz operation with the internal clock operating at maximum speed.

MB89210 Series

■ PACKAGES AND CORRESPONDING PRODUCTS

Package	MB89215	MB89F217	MB89P215	MB89PV210
FPT-30P-M02	○	×	○	× *1
FPT-48P-M13	○	○	×	× *2
MQP-48C-P02	×	×	×	○
Power supply pins	Vcc, Vss × 2	Vcc, Vss × 3, AVcc, AVss	Vcc, Vss × 2	Vcc, Vss × 2, AVcc, AVss

○ : Yes × : No

*1 : Adapter for 48-pin to 30-pin conversion (manufactured by Sunhayato Corp.)

Part number : 48QF-30SOP-8L

Inquiry : Sunhayato Corp. TEL : (81)-3-3984-7791
FAX : (81)-3-3971-0535
E-mail : adapter@sunhayato.co.jp

*2 : Adapter for 48-pin (EVA) to 48-pin (MASK/FLASH) conversion.

Part number : 48QF2-48QF2-8L-FJ

Inquiry : Sunhayato Corp. TEL : (81)-3-3984-7791
FAX : (81)-3-3971-0535
E-mail : adapter@sunhayato.co.jp

■ DIFFERENCES AMONG PRODUCTS

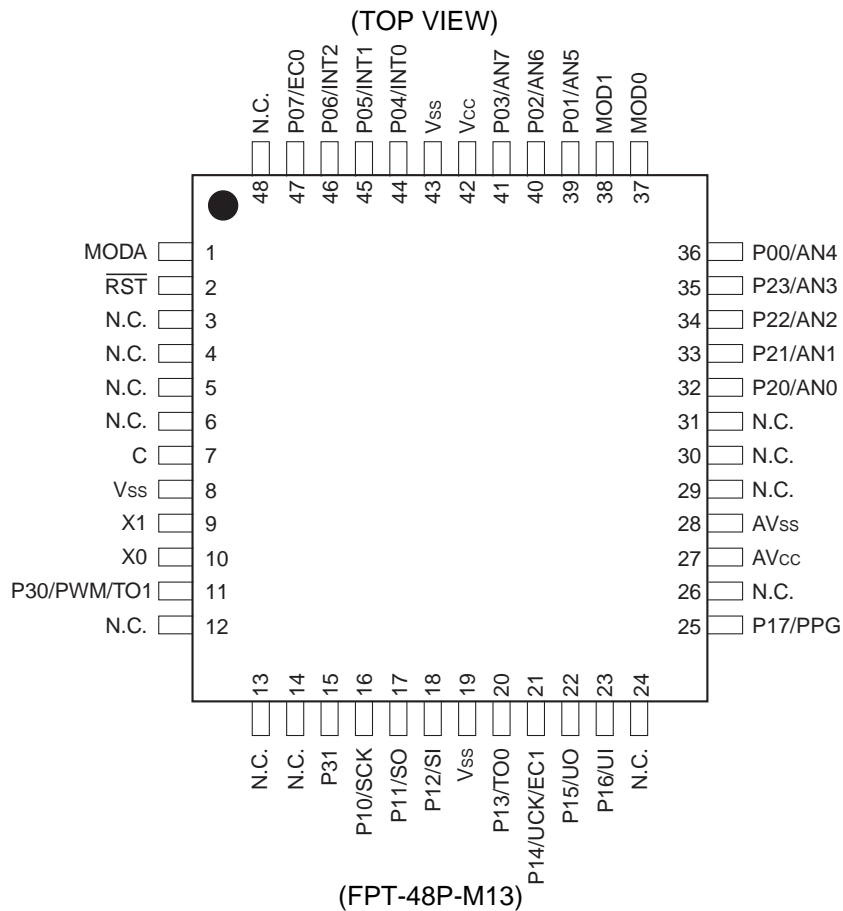
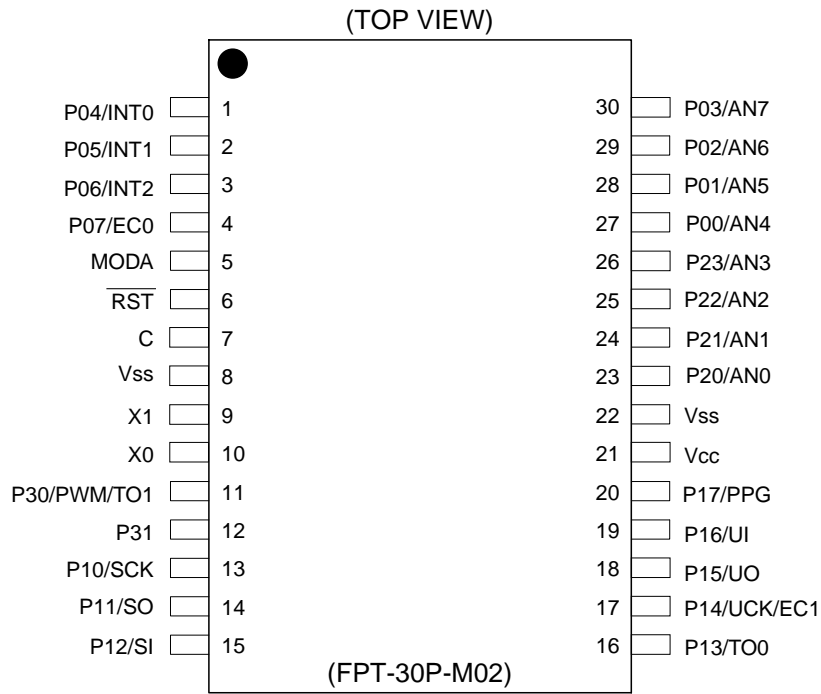
1. Memory space

When this product is used in a piggy-back or other evaluation configuration, it is necessary to carefully confirm the differences between the model being used and the product it is evaluating.

2. Current Consumption

- On the MB89PV210, the additional current consumed by the EPROM is added at the connecting socket on the back side.
- When operating at low speed, the current consumption in the one-time PROM or EPROM models is greater than on the mask ROM models. However, current consumption in sleep or stop modes is identical. However, in sleep/stop mode the current consumption is the same.

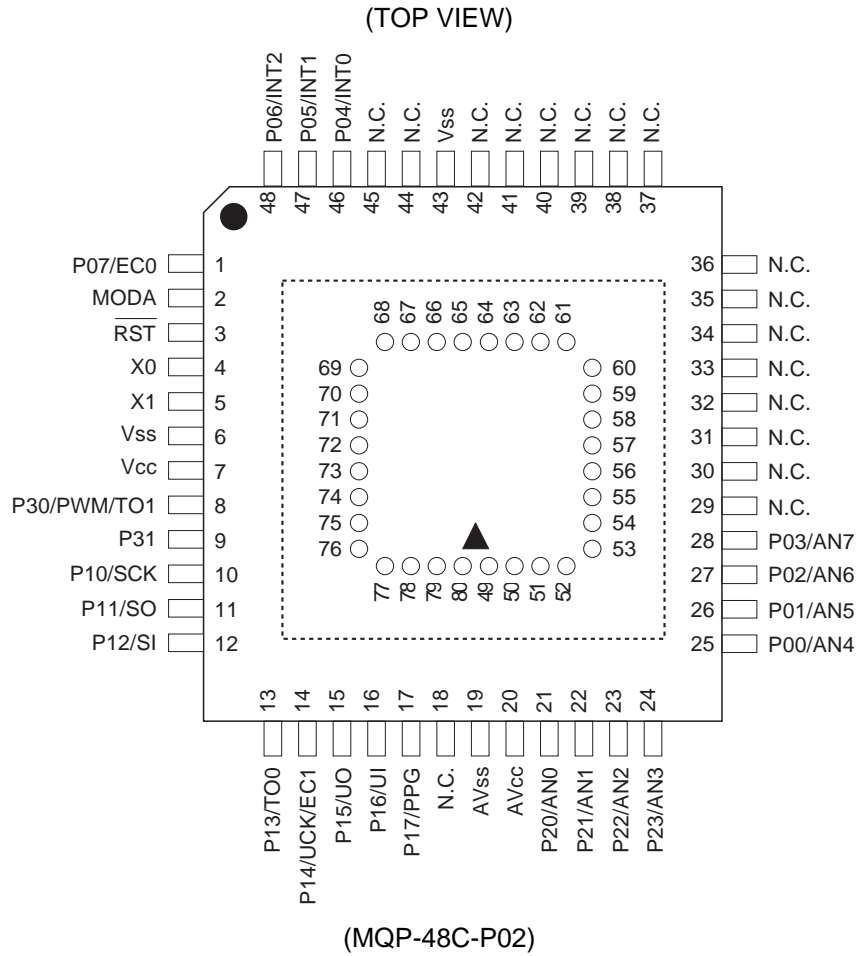
PIN ASSIGNMENT



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MB89210 Series

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Pin no.	Pin	Pin no.	Pin	Pin no.	Pin	Pin no.	Pin
49	Vpp	57	N.C.	65	O4	73	OE
50	A12	58	A2	66	O5	74	N.C.
51	A7	59	A1	67	O6	75	A11
52	A6	60	A0	68	O7	76	A9
53	A5	61	O1	69	O8	77	A8
54	A4	62	O2	70	CE	78	A13
55	A3	63	O3	71	A10	79	A14
56	N.C.	64	Vss	72	N.C.	80	Vcc

N.C. : Internal connection only. Not for use.

■ PIN DESCRIPTIONS

Pin no.			Pin name	Circuit type	Function
SSOP*1	QFP*2	MQFP*3			
10	10	4	X0	A	Connecting pins to crystal oscillator or other oscillator. When using external clock, input to X0 and X1 is left open.
9	9	5	X1		
—	37	—	MOD0	C/D ₁ *4	Input pins for memory access mode setting. Connect directly to V _{SS} .
—	38	—	MOD1		Input pins for memory access mode setting. Connect directly to V _{SS} .
5	1	2	MODA	C/D ₂ *5	Input pins for memory access mode setting. Connect directly to V _{SS} .
6	2	3	$\overline{\text{RST}}$	E	Reset I/O pin. This pin has pull-up resistance with N-ch open drain or hysteresis input. At an internal reset request, an “L” signal is output. An “L” level input initializes the internal circuits.
27 to 30	36, 39 to 41	25 to 28	P00/AN4 to P03/AN7	G	General purpose I/O port. Hysteresis input. These pins also functions as the analog input of A/D converter.
1 to 3	44 to 46	46 to 48	P04/INT0 to P06/INT2	F	General purpose I/O port. These pins also functions as the external interrupt input. Hysteresis input.
4	47	1	P07/EC0		General purpose I/O port. This pin also functions as external clock of 8-/16-bit capture timer/counter 0 or capture input pin. Hysteresis input.
13	16	10	P10/SCK		General purpose I/O port. This pin also functions as clock input/output pin of serial I/O. Hysteresis input.
14	17	11	P11/SO		General purpose I/O port. This pin also functions as the data output pin of serial I/O. Hysteresis input.
15	18	12	P12/SI		General purpose I/O port. This pin also functions as the data input pin of serial I/O. Hysteresis input.
16	20	13	P13/TO0		General purpose I/O port. This pin also functions as the output pin of 8-/16-bit capture timer/counter 0. Hysteresis input.
17	21	14	P14/UCK/ EC1		General purpose I/O port. This pin also functions as the clock input/output pin of LIN-UART and the external clock of 8-/16-bit capture timer/counter 1 or capture input pin. Hysteresis input.
18	22	15	P15/UO		General purpose I/O port. This pin also functions as the data output pin of LIN-UART. Hysteresis input

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MB89210 Series

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Pin no.			Pin name	Circuit type	Function
SSOP*1	QFP*2	MQFP*3			
19	23	16	P16/UI	H	General purpose I/O port. This pin also functions as the data input pin of LIN-UART. General port input is hysteresis and resource input is CMOS.
20	25	17	P17/PPG	F	General purpose I/O port. This pin also functions as 12-bit PPG timer output. Hysteresis input.
23 to 26	32 to 35	21 to 24	P20/AN0 to P23/AN3	G	General purpose I/O port. Shared for A/D converter analog input pin. Hysteresis input.
11	11	8	P30/PWM/ TO1	F	General purpose I/O port. This pin also functions as the output pin of 8-bit PWM and 8-/16-bit capture timer/counter 1. Hysteresis input.
12	15	9	P31	B	General purpose I/O port of CMOS type.
21	42	7	V _{CC}	—	Power supply pin.
8,22	8, 19, 43	6,43	V _{SS}	—	Power supply pin (GND). Use the both pins at the same voltage level.
—	27	20	AV _{CC}	—	A/D converter power supply pin. Apply potential under V _{CC} to this pin.
—	28	19	AV _{SS}	—	A/D converter power supply pin (GND). Use at the same voltage level as the V _{SS} supply.
7	7	—	C	—	This is the power supply stabilization capacitor pin for MB89F217 and MB89P215. Connect an external capacitor of 0.1 μ F. MB89215 is not internally connected. It is unnecessary to connect a capacitor.
—	3 to 6, 12 to 14, 24, 26, 29 to 31, 48	18, 29 to 42, 44,45	N.C.	—	Internal connect pin. Be sure this pin is left open.

*1 : FPT-30P-M02

*2 : FPT-48P-M13

*3 : MQP-48C-P02

*4 : MB89F217 is C.

*5 : MB89F217 and MB89P215 are C.

■ EXTERNAL EPROM PIN DESCRIPTION (MB89PV210 only)

Pin no.	Pin name	I/O	Function
49	Vpp	O	"H" level output pin.
50	A12	O	Address output pin.
51	A7		
52	A6		
53	A5		
54	A4		
55	A3		
58	A2		
59	A1		
60	A0		
61	O1	I	Data input pin.
62	O2		
63	O3		
64	Vss	O	Power supply pin (GND).
65	O4	I	Data input pin.
66	O5		
67	O6		
68	O7		
69	O8		
70	CE	O	Chip acceptance pin for ROM. Output "H" at standby.
71	A10	O	Address output pin.
73	OE	O	Output acceptance pin for ROM. Output "L" usually.
75	A11	O	Address output pin.
76	A9		
77	A8		
78	A13		
79	A14		
80	Vcc	O	Power supply pin for EPROM.
56	N.C.	—	Internal connect pin. Must be left open.
57			
72			
74			

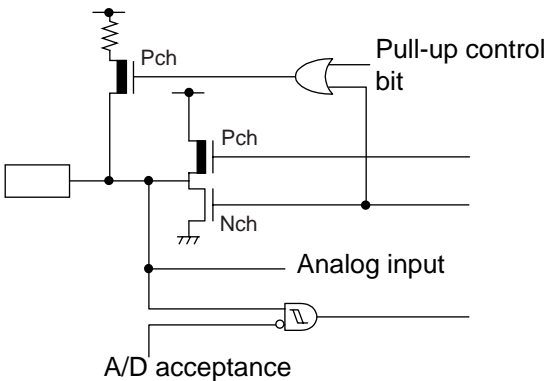
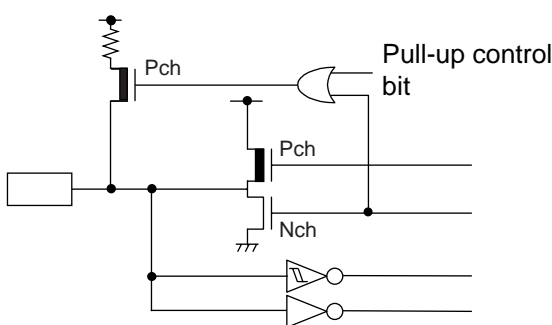
MB89210 Series

I/O CIRCUIT TYPE

Type	Circuit	Remarks
A		<ul style="list-style-type: none"> Oscillator feedback resistance : approx. 1 MΩ
B		<ul style="list-style-type: none"> CMOS input
C		<ul style="list-style-type: none"> Hysteresis input
D ₁		<ul style="list-style-type: none"> Open
D ₂		<ul style="list-style-type: none"> With pull-down resistance : approx. 50 kΩ(5V) Hysteresis input
E		<ul style="list-style-type: none"> Output pull-up resistance (Pch) approx. 50 kΩ (5V) Hysteresis input
F		<ul style="list-style-type: none"> CMOS output Hysteresis input Selectable by pull-up resistor register

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Type	Circuit	Remarks
G		<ul style="list-style-type: none"> • CMOS output • Hysteresis input • Analog input • Selectable by pull-up resistor register
H		<ul style="list-style-type: none"> • CMOS output • Hysteresis input • CMOS input • Selectable by pull-up resistor register

MB89210 Series

■ HANDLING DEVICES

1. Preventing Latchup

Latchup may occur on CMOS ICs if voltage higher than V_{CC} or lower than V_{SS} is applied to input or output pins other than the medium-and high-voltage pins or if voltage higher than the rating is applied between V_{CC} and V_{SS} .

When latchup occurs, power supply current increases rapidly and might thermally damage elements. When using, take great care not to exceed the absolute maximum ratings.

Also, take care to prevent the analog input from exceeding the digital power supply (V_{CC}) when the analog system power supply is turned on and off.

To supply power, turn on the digital power supply (V_{CC}) and then the analog power supply (AV_{CC}).

2. Treatment of Unused Input Pins

Leaving unused input terminals open may lead to permanent damage due to malfunction and latchup; pull up or pull down the terminals through the resistors of 2 k Ω or more.

Make the unused I/O terminal in a state of output and leave it open and if it is in an input state, handle it with the same procedure as the input terminals.

3. Treatment of N.C. Pins

Any pins marked "NC" (not connected) must be left open.

4. Power Supply Voltage Fluctuations

Although V_{CC} power supply voltage is assured to operate within the rated range, a rapid fluctuation of the voltage could cause malfunctions even if it occurs within the rated range. Stabilizing voltage supplied to the IC is therefore important. As stabilization guidelines, it is recommended to control power so that V_{CC} ripple fluctuations (P-P value) will be less than 10% of the standard V_{CC} value at the commercial frequency (50 to 60 Hz) and the transient fluctuation rate will be less than 0.1 V/ms.

5. Treatment of power supply pin

All V_{SS} power supply pin must be use at the same voltage level.

Connect to be $AV_{CC} = V_{CC}$, $AV_{SS} = V_{SS}$ even if the A/D converters are not in use in MB89PV210.

6. Notes on Using External Clock

When an external clock is used, oscillation stabilization time is required for even power-on reset and release from stop mode.

7. Notes on using the CR (internal) oscillator

To use the CR (internal) oscillator as the operating clock for the MB89215, MB89F217 or MB89P215, adjust the timer value and baud rate setting.

8. Program Execution in RAM

When the MB89PV210 is used with an emulation pod other than the MB2144-508, no program can be executed in RAM.

9. Operation check for evaluating the LIN-UART

When the MB89215, MB89F217 or MB89P215 uses the CR (internal) oscillator as the clock for the LIN-UART, the evaluation program (MB89PV210 [customized for external oscillation]) requires an operation check within a range of oscillation frequencies from 8.5 MHz to 11.5 MHz.

10. Handling reset pin

Reset pin must be inputted external reset.

11. Up/down conversion circuit stabilization waiting time

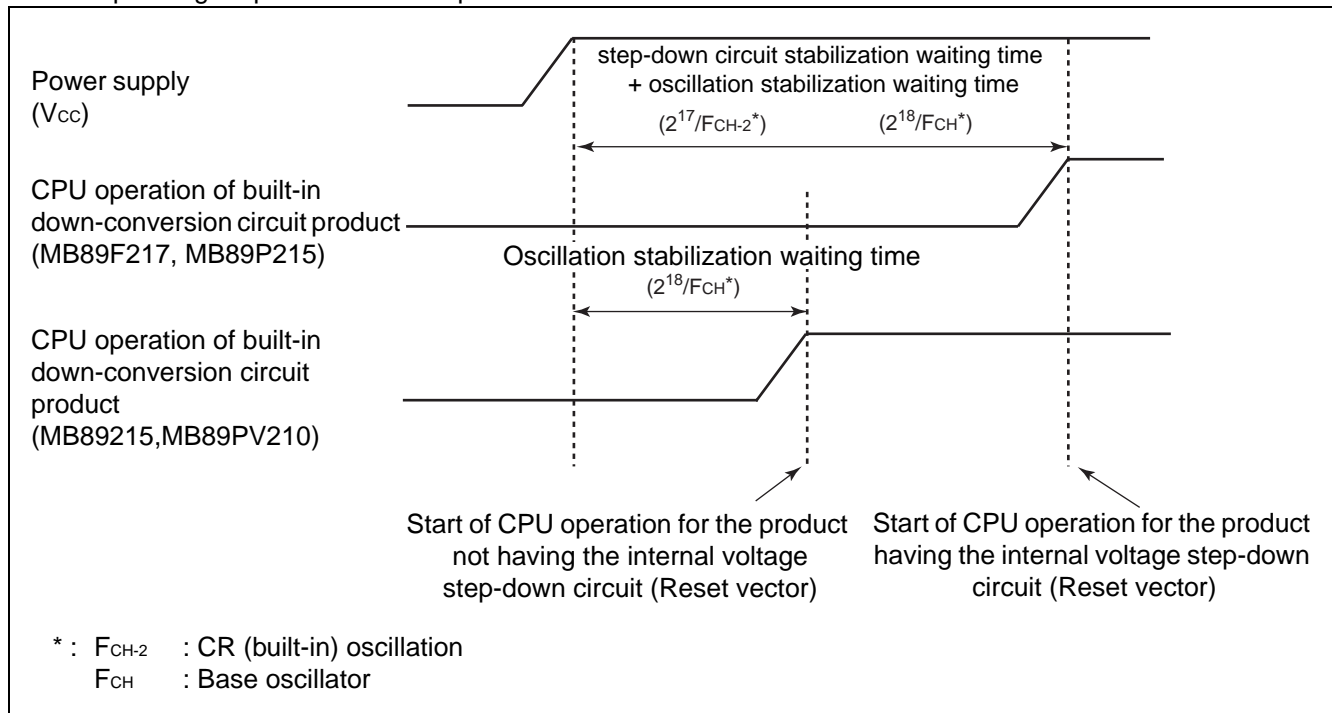
MB89210 series contains the following products and the operating characteristics vary with whether they contain the internal stepdown circuit.

Product name	Operating voltage *	Down conversion
MB89215	3.5 V to 5.5 V	not built-in
MB89F217	3.5 V to 5.5 V	built-in
MB89P215	3.5 V to 5.5 V	built-in
MB89PV210	3.5 V to 5.5 V	not built-in

* : The minimum operating voltage varies with the operating frequency, the function and the connected ICE.

The same built-in resources are used for the above product types; operating sequences after the power-on reset are different depending on whether they have the internal voltages step-down circuit.

The operating sequences after the power-on reset with the different models will be described below.



As described above, CPU starts at delayed time with the product having the internal voltage step-down circuit compared with the product not having the internal voltage step-down circuit. This is because the time should be allowed for the stabilization time for voltage step-down circuit for normal operation.

Note : As the period of the oscillation is unstable immediately after oscillation starts, the listed oscillation stabilization delay times are guides only.

12. Treatment of analog input

The analog input also serves as a general-purpose input/output port. The A/D enable register is initialized at a reset. When the intermediate-level signal is input in port input mode (ADEN:ADEx = 0), an input leakage current flows to the gate. Set the corresponding pin to an analog input.

MB89210 Series

PROGRAMMING AND ERASING FLASH MEMORY ON THE MB89F217

1. Flash Memory

The flash memory is located between 8000_H and FFFF_H in the CPU memory map and incorporates a flash memory interface circuit that allows read access and program access from the CPU to be performed in the same way as mask ROM. Programming and erasing flash memory is also performed via the flash memory interface circuit by executing instructions in the CPU. This enables the flash memory to be updated in place under the control of the CPU, providing an efficient method of updating program and data.

2. Flash Memory Features

- 32 K byte × 8-bit configuration : (16 K + 8 K + 8 K sectors)
- Automatic programming algorithm (Embedded algorithm* : Equivalent to MBM29LV200)
- Includes an erase pause and restart function
- Data polling and toggle bit for detection of program/erase completion
- Detection of program/erase completion via CPU interrupt
- Compatible with JEDEC-standard commands
- Sector Erasing (sectors can be combined in any combination)
- No. of program/erase cycles : 10,000 (Min)

* : Embedded Algorithm is a trademark of Advanced Micro Devices.

3. Procedure for Programming and Erasing Flash Memory

Programming and reading flash memory cannot be performed at the same time. Accordingly, to program or erase flash memory, the program must first be copied from flash memory to RAM so that programming can be performed without program access from flash memory.

4. Flash Memory Register

- Control status register (FMCS)

Address 007A _H	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	Initial value 0 0 0 X 0 0 - 0 _B
	INTE	RDYINT	WE	RDY	Reserved	Reserved	—	Reserved	
	R/W	R/W	R/W	R	R/W	R/W	—	R/W	

5. Sector Configuration

The table below shows the sector configuration of flash memory and lists the address of each sector for both during CPU access a flash memory programming.

- Sector configuration of flash memory

FLASH Memory	CPU Address	Programming Address*
16 K bytes	FFFF _H to C000 _H	1FFFF _H to 1C000 _H
8 K bytes	BFFF _H to A000 _H	1BFFF _H to 1A000 _H
8 K bytes	9FFF _H to 8000 _H	19FFF _H to 18000 _H

* : The programmer address is the address to be used instead of the CPU address when programming data from a parallel flash memory programmer. Use the programmer address on programming or erasing using a general-purpose parallel programmer.

6. ROM Writer Adapters and Recommended ROM Writers

Part number	Package name	Applicable adapter model	Recommended writer	
		Sunhayato Corp.	Ando Electric Co., Ltd.	MINATO ELECTRONICS INC.
MB89F217PFM	FPT-48P-M13	FLASH-48QF2-32DP-8LF	AF9708*1 AF9709/09B*1	MODEL-1890A*2 Ver2.8 or more

*1 : For the writer version and type code, please check the device list in homepage of the Flash Support Group, Inc as follow ; <http://www.j-fsg.co.jp/>

*2 : In addition to this adaptor, the conversion basis is required
Conversion basis : H910-1148

Inquiries : Sunhayato Corp.

TEL : (81) -3-3984-7791
FAX : (81) -3-3971-0535
E-mail : adapter@sunhayato.co.jp

Flash Support Group, Inc

FAX : (81) -53-428-8377

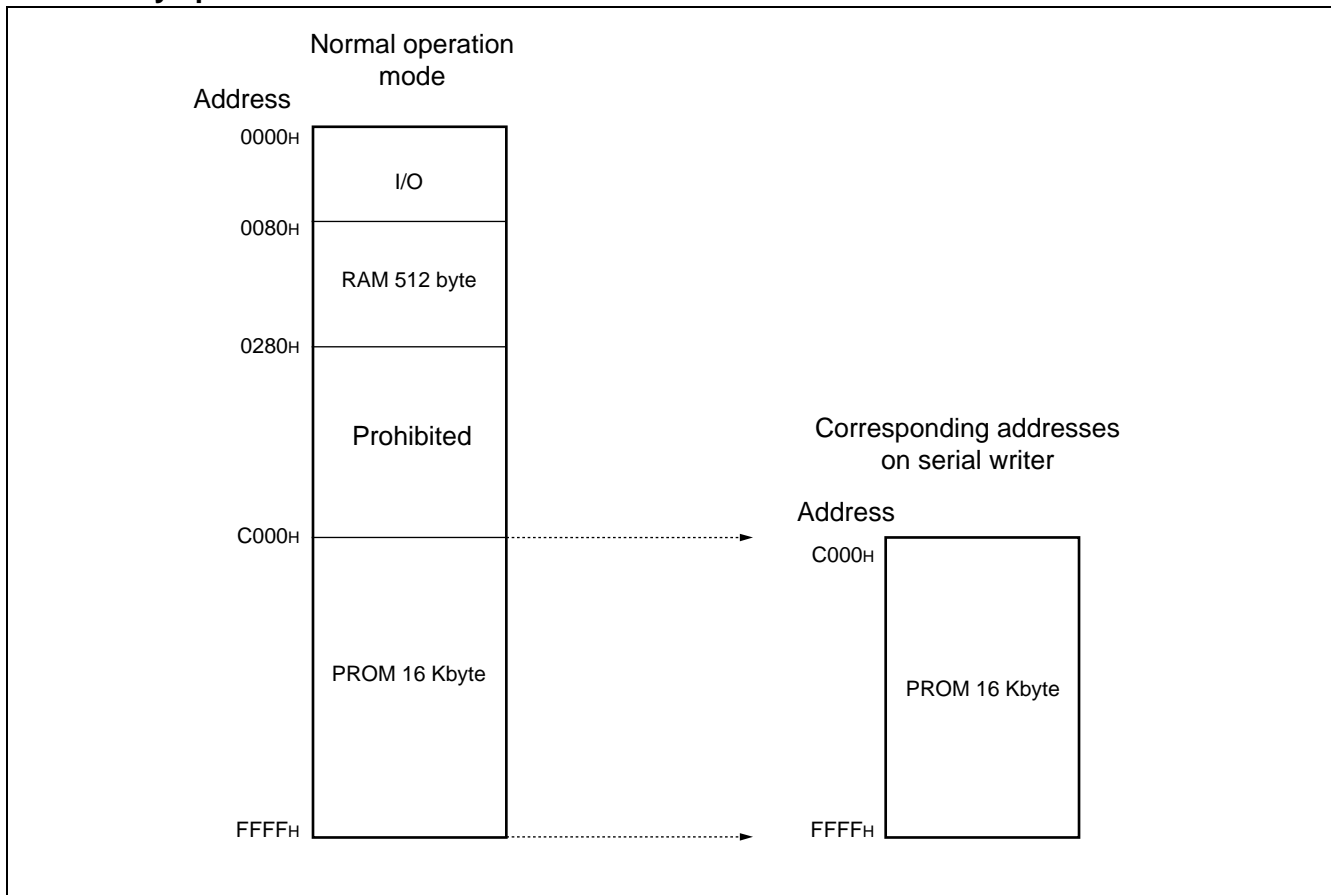
MINATO ELECTRONICS INC.

TEL : (81) -45-591-5611
FAX : (81) -45-592-2854

MB89210 Series

PROGRAMMING TO OTPROM ON THE MB89P215

1. Memory space



2. Programming to the OTPROM

To program to the OTPROM using an EPROM programmer AF220/AF210/AF120/AF110 (manufacturer : Yokogawa Digital Computer Corp.).

Inquiry : Yokogawa Digital Computer Corp. : TEL(81)-42-333-6224

Note : Programming to the OTPROM with MB89P215 is serial programming mode only.

3. Programming Adaptor for OTPROM

To program to the OTPROM using an EPROM programmer AF220/AF210/AF120/AF110, use the programming adaptor (manufacturer : Sunhayato Corp.) listed below.

Adaptor socket : ROM3-FPT30M02-8L3

Inquiry : Sunhayato Corp. : TEL : (81)-3-3984-7791
FAX : (81)-3-3971-0535
E-mail : adapter@sunhayato.co.jp

4. Programming yields

All bits cannot be programmed at Fujitsu shipping test to a blanked OTPROM microcomputer, due to its nature. For this reason, a programming yield of 100% cannot be assured at all times.

■ EPROM WRITING TO PIGGY-BACK/EVALUATION CHIPS

1. EPROM model

MBM27C256A-20TVM

2. Writer adapter

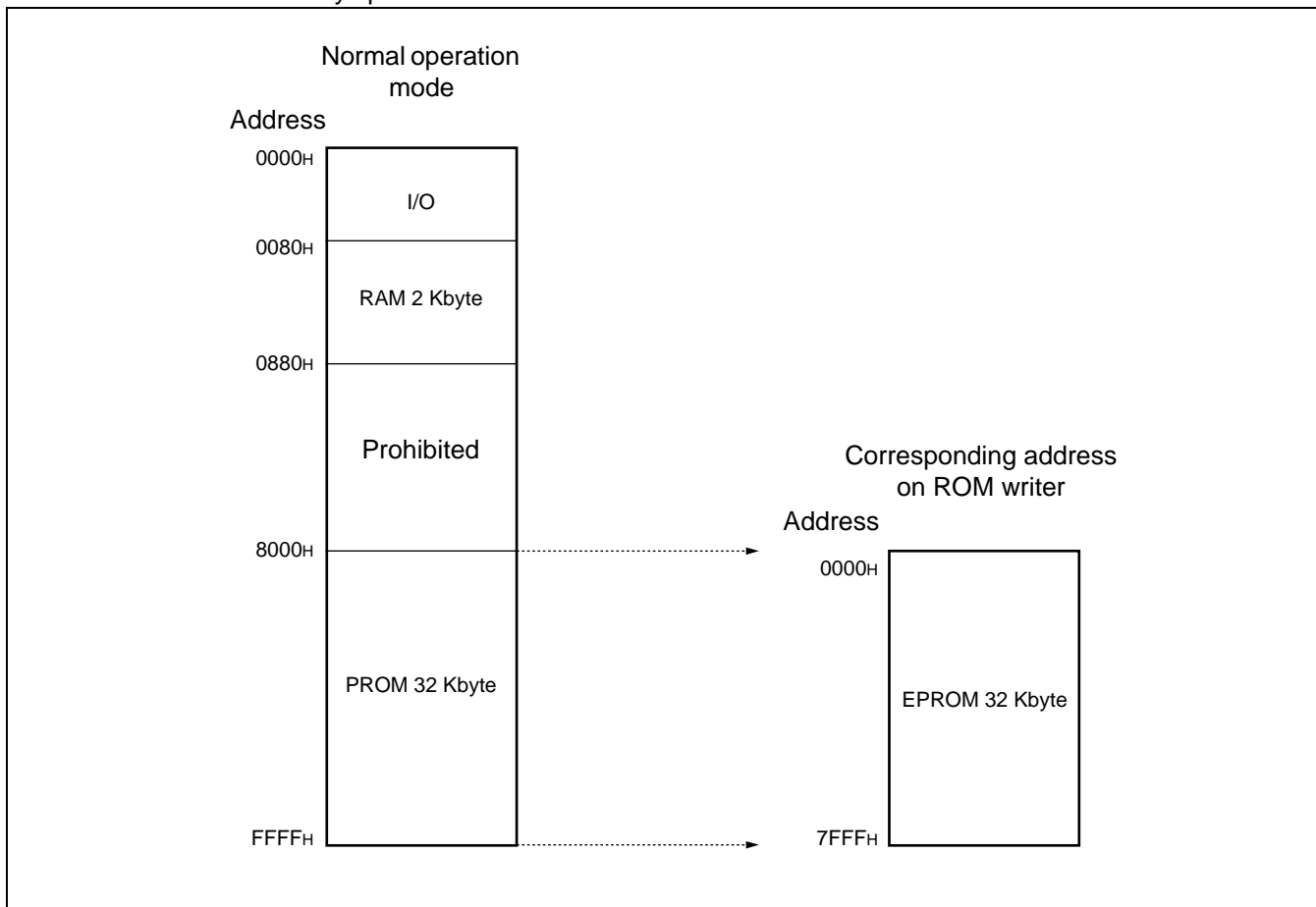
For writing to EPROM using a ROM writer, use one of the writer adapters shown below (manufactured by Sunhayato).

Package	Adapter socket model
LCC-32	ROM-32LC-28DP-S

Inquiries should be addressed to Sunhayato Corp. : TEL : (81)-3-3984-7791
 FAX : (81)-3-3971-0535
 E-mail : adapter@sunhayato.co.jp

3. Memory space

Shown below the memory space in each mode.

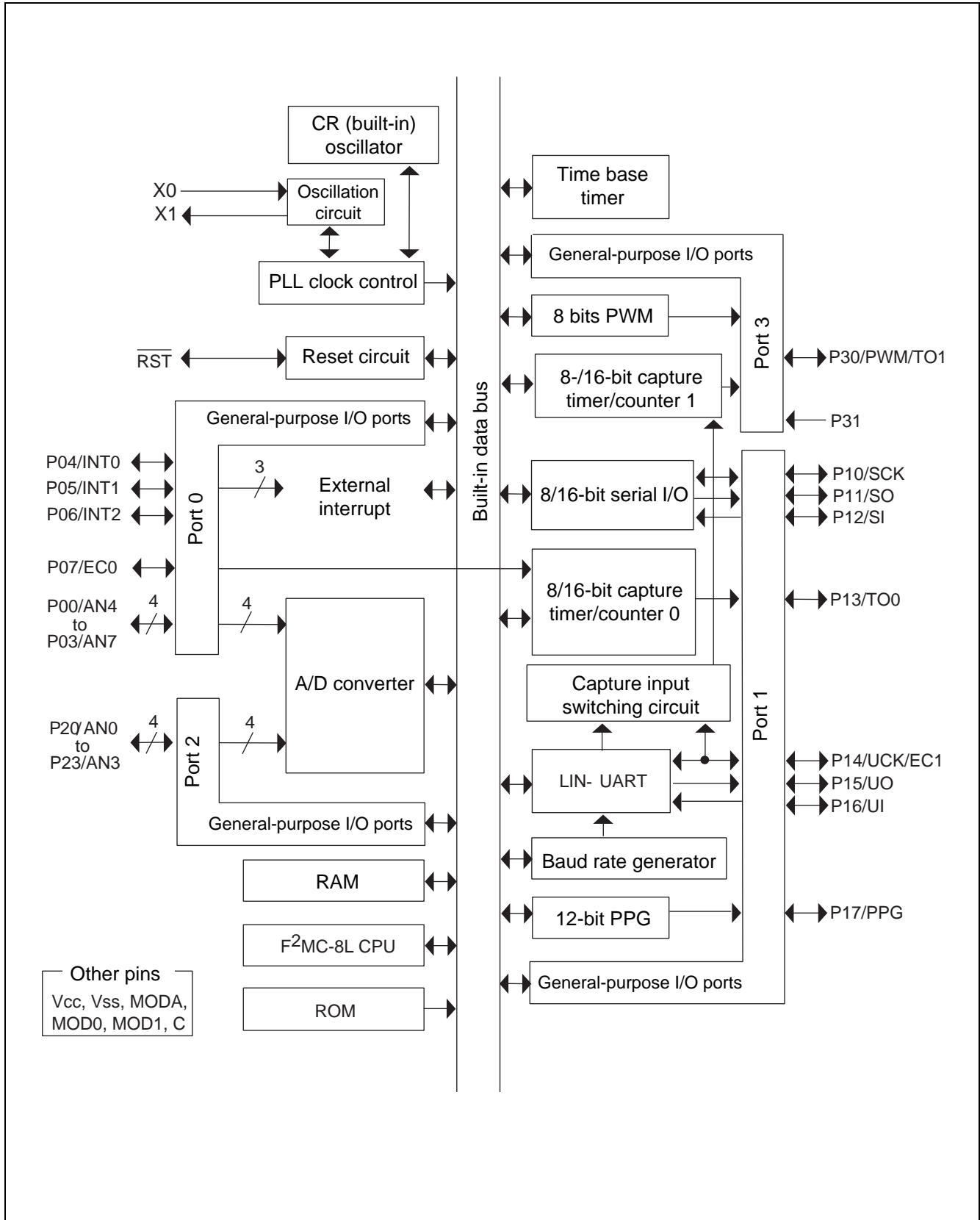


4. Writing to EPROM

- (1) Set up the EPROM writer for the MBM27C256A.
- (2) Load program data on to the EPROM programmer at 0000H to 7FFFH.
- (3) Program 0000H to 7FFFH with the EPROM programmer.

MB89210 Series

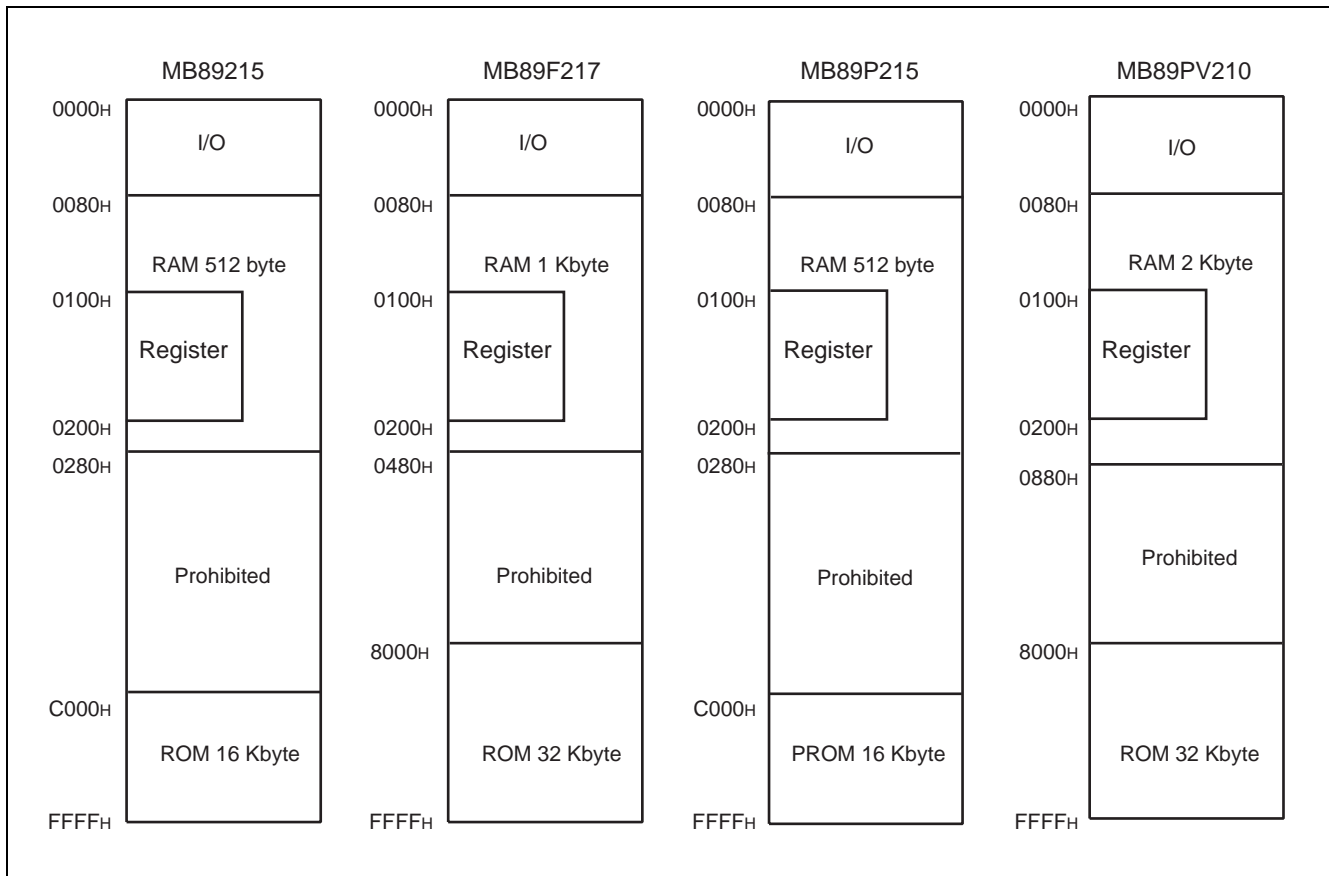
■ BLOCK DIAGRAM



■ CPU CORE

1. Memory space

The MB89210 series has 64 KB of memory space, containing all I/O, data areas, and program areas. The I/O area is located at the lowest addresses, with the data area placed immediately above. The data area can be partitioned into register areas, stack areas, or direct access areas depending on the application. The program area is located at the opposite end of memory, closest to the highest addresses, and the highest part of this area is assigned to the tables of interrupt and reset vectors and vector call instructions. The following diagram shows the structure of memory space in the MB89210 series.

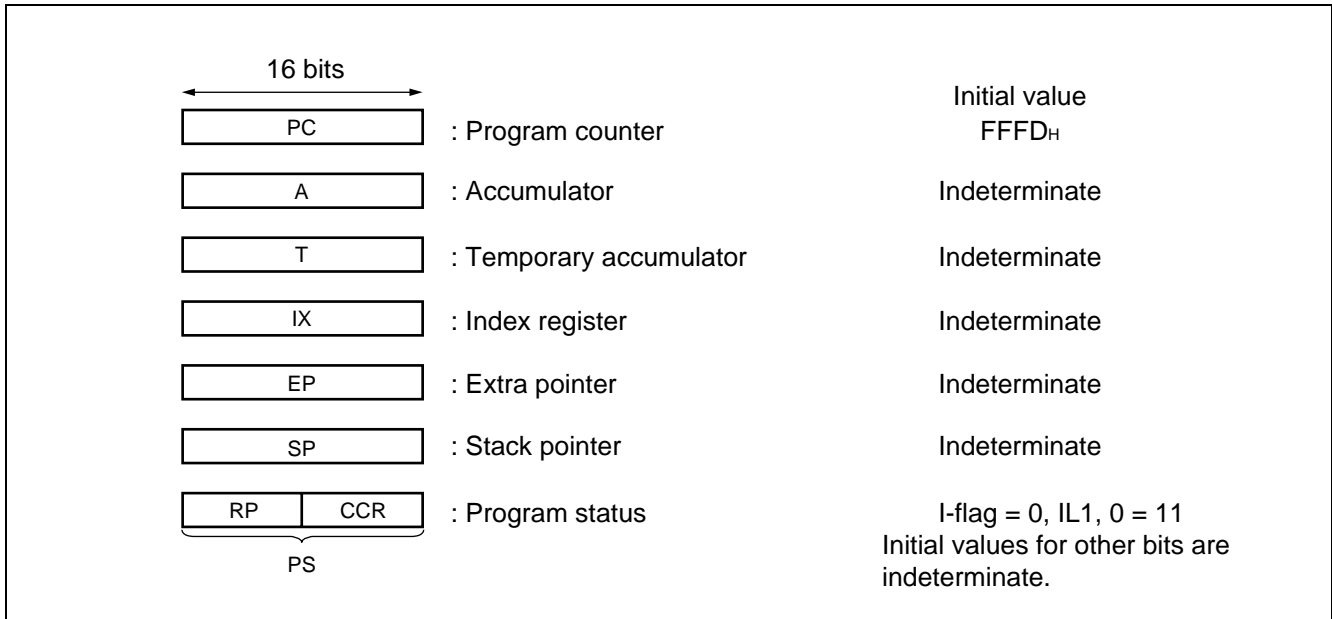


MB89210 Series

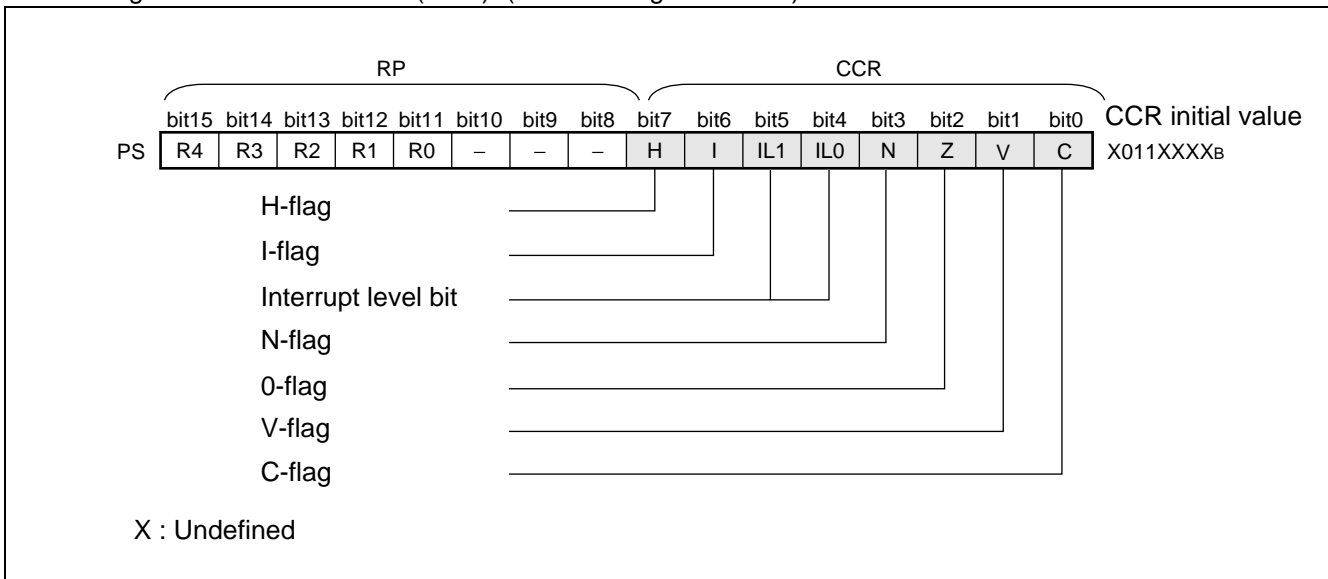
2. Register

The MB89210 series has two types of registers; the registers dedicated to specific purposes in the CPU and the general-purpose registers. The dedicated registers are as follows:

- Program counter (PC) : 16-bit length, shows the locations where instructions are stored.
- Accumulator (A) : 16-bit length, a temporary memory register for calculation operations. In the case of an 8-bit data processing instruction, the lower one byte is used.
- Temporary accumulator (T) : 16-bit length, performs calculations with the accumulator. In the case of an 8-bit data processing instruction, the lower one byte is used.
- Index register (IX) : 16-bit length, a register for index modification.
- Extra pointer (EP) : 16-bit length, a pointer indicating memory addresses.
- Stack pointer (SP) : 16-bit length, indicates stack areas.
- Program status (PS) : 16-bit length, contains register pointer and condition code.

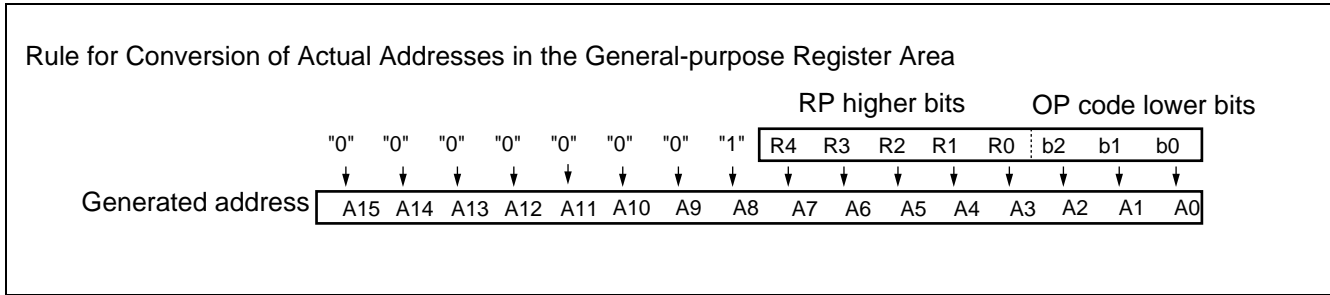


The PS register can further be divided into the register bank pointer in the higher 8 bits (RP) and the condition code register in the lower 8 bits (CCR). (See the diagram below.)



MB89210 Series

The RP points to the address of the register bank currently in use. The relationship between the pointer contents and the actual address is based on the conversion rule shown next.



The CCR consists of the bits indicating arithmetic operation results or transfer data contents and the bits that control CPU operations at the time of an interrupt.

- H flag : Set to 1 if calculations result in carry operations from bit 3 to bit 4 or borrow operations from bit 4 to bit 3, otherwise set to 0.
The flag is for decimal adjustment instructions; do not use for other than additions and subtractions.
- I flag : This flag is set to 1 if interrupts are enabled, and 0 if interrupts are prohibited. The default value at reset is 0.
- IL1, 0 : Indicates the level of the interrupt currently enabled.
An interrupt is processed only if its level is higher than the value this bit indicates.

IL1	IL0	Interrupt level	High-low
0	0	1	Higher ↑↓ Lower = no interruption
0	1		
1	0	2	
1	1	3	

- N flag : Set to 1 if the highest bit is 1 after a calculation, otherwise cleared to 0.
- Z flag : Set to 1 if a calculation result is 0, otherwise cleared to 0.
- V flag : Set to 1 if a 2's complement overflow results during a calculation, otherwise cleared to 0.
- C flag : Set to 1 if a calculation results in a carry or borrow operation from bit 7, otherwise cleared to 0.
This is also the shift-out value in a shift instruction.

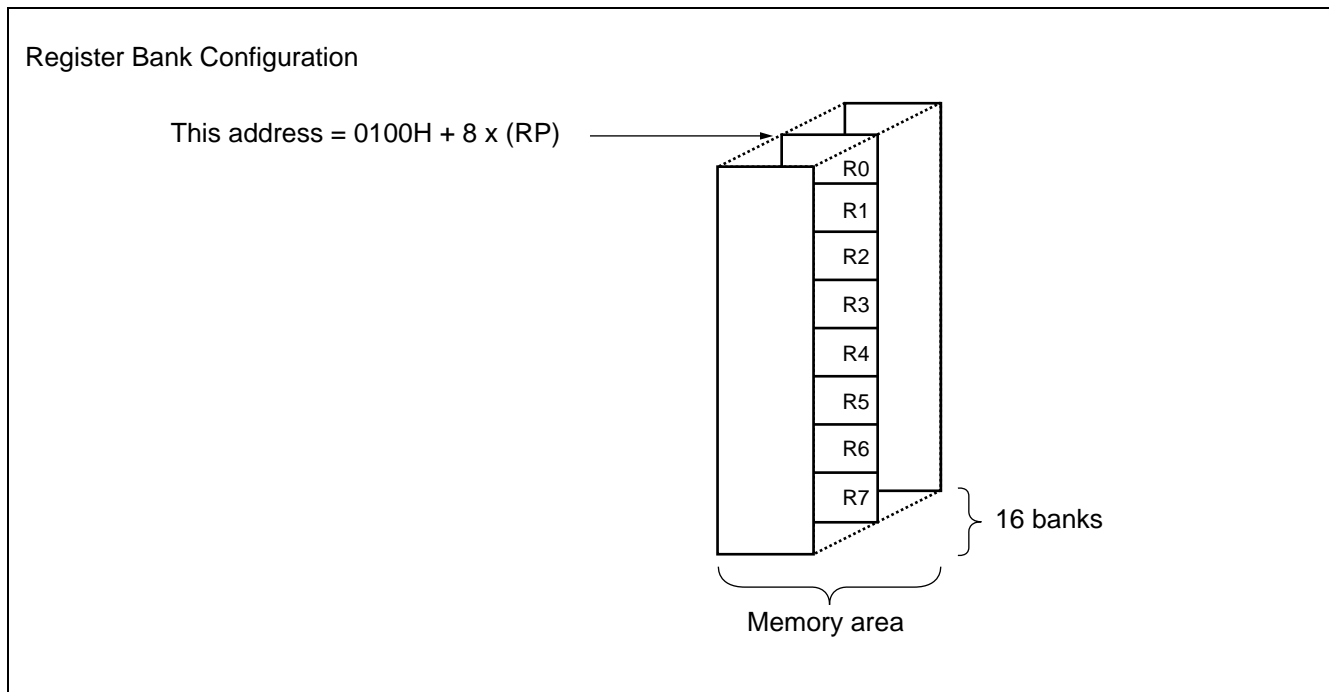
MB89210 Series

The following general-purpose registers are provided:

General-purpose registers: 8-bit length, data storage registers

The general-purpose registers are 8 bits in length and located in the register banks in the memory. One bank contains eight registers and the MB89210 series allow a total of 16 banks to be used at maximum.

The bank currently in use is indicated by the register bank pointer (RP).



MB89210 Series

■ I/O MAP

Address	Register name	Register description	Read/write	Initial value
0000 _H	PDR0	Port 0 data register	R/W	XXXXXXXX
0001 _H	DDR0	Port 0 direction register	R/W	00000000
0002 _H to 0006 _H	Access prohibited			
0007 _H	SYCC	System clock control register	R/W	1--11100
0008 _H	STBC	Standby control register	R/W	00010---
0009 _H	WDTC	Watchdog timer control register	W	0---XXXX
000A _H	TBTC	Time base timer control register	R/W	00---000
000B _H	Access prohibited			
000C _H	PDR1	Port 1 data register	R/W	XXXXXXXX
000D _H	DDR1	Port 1 direction register	R/W	00000000
000E _H	RSFR	Reset flag register	R	XXXX----
000F _H	PDR2	Port 2 data register	R/W	----XXXX
0010 _H	DDR2	Port 2 direction register	R/W	----0000
0011 _H	Access prohibited			
0012 _H	PDR3	Port 3 data register	R/W	-----XX
0013 _H	DDR3	Port 3 direction register	R/W	-----0
0014 _H	RCR21	12-bit PPG control register 1	R/W	00000000
0015 _H	RCR22	12-bit PPG control register 2	R/W	--000000
0016 _H	RCR23	12-bit PPG control register 3	R/W	0-000000
0017 _H	RCR24	12-bit PPG control register 4	R/W	--000000
0018 _H	Access prohibited			
0019 _H	TCCR0	Capture control register 0	R/W	00000000
001A _H	TCR10	Timer 1 control register 0	R/W	000-0000
001B _H	TCR00	Timer 0 control register 0	R/W	00000000
001C _H	TDR10	Timer 1 Data 0	R/W	XXXXXXXX
001D _H	TDR00	Timer 0 Data 0	R/W	XXXXXXXX
001E _H	TCPH0	Capture data register H 0	R	XXXXXXXX
001F _H	TCPL0	Capture data register L 0	R	XXXXXXXX
0020 _H	TCR20	Timer output control 0	R/W	-----00
0021 _H	Access prohibited			
0022 _H	CNTR	PWM control register	R/W	0-000000
0023 _H	COMR	PWM Compare register	W	XXXXXXXX
0024 _H	EIC1	External interrupt control register 1 (edge)	R/W	00000000
0025 _H	EIC2	External interrupt control register 2 (edge)	R/W	00000000

(Continued)

MB89210 Series

Address	Register name	Register description	Read/write	Initial value
0026 _H	Access prohibited			
0027 _H				
0028 _H	SCR	Serial control register	R/W	0 0 0 0 0 0 0 0
0029 _H	USMR	LIN-UART serial mode register	R/W	0 0 0 0 0 0 0 0
002A _H	SSR	Serial status register	R/W	0 0 0 0 1 0 0 0
002B _H	RDR	Receiving data register	R	0 0 0 0 0 0 0 0
	TDR	Sending data register	W	1 1 1 1 1 1 1 1
002C _H	ESCR	Extended status control register	R/W	0 0 0 0 0 X 0 0
002D _H	ECCR	Extended communication control register	R/W	0 0 0 0 0 – 1 1
002E _H	BGRH	Baud rate generator register H	R/W	– 0 0 0 0 0 0 0
002F _H	BGRL	Baud rate generator register L	R/W	0 0 0 0 0 0 0 0
0030 _H	ADC1	A/D control register 1	R/W	0 0 0 0 0 0 0 0
0031 _H	ADC2	A/D control register 2	R/W	0 0 0 0 0 0 0 1
0032 _H	ADDH	A/D data register H	R/W	0 0 0 0 0 0 XX
0033 _H	ADDL	A/D data register L	R/W	XXXXXXXX
0034 _H	ADEN	A/D enable register	R/W	0 0 0 0 0 0 0 0
0035 _H to 0038 _H	Access prohibited			
0039 _H	SMR	Serial mode register	R/W	0 0 0 0 0 0 0 0
003A _H	SDR	Serial Data register	R/W	XXXXXXXX
003B _H to 0040 _H	Access prohibited			
0041 _H	TCCR1	Capture control register 1	R/W	0 0 0 0 0 0 0 0
0042 _H	TCR11	Timer 1 control register 1	R/W	0 0 0 – 0 0 0 0
0043 _H	TCR01	Timer 0 control register 1	R/W	0 0 0 0 0 0 0 0
0044 _H	TDR11	Timer 1 Data register 1	R/W	XXXXXXXX
0045 _H	TDR01	Timer 0 Data register 1	R/W	XXXXXXXX
0046 _H	TCPH1	Capture status register H1	R	XXXXXXXX
0047 _H	TCPL1	Capture status register L1	R	XXXXXXXX
0048 _H	TCR21	Timer output control register 1	R/W	– – – – – 0 0
0049 _H	TCSL	Capture input select register	R/W	– – – – – 0
004A _H to 005F _H	Access prohibited			
0060 _H	XCRS*	External/CR(built-in)oscillation clock control register	R/W	0 0 – 0 0 0 1 0
0061 _H to 006F _H	Access prohibited			

(Continued)

MB89210 Series

(Continued)

Address	Register name	Register description	Read/write	Initial value
0070 _H	PUL0	Port 0 pull-up setting register	R/W	0 0 0 0 0 0 0 0
0071 _H	PUL1	Port 1 pull-up setting register	R/W	0 0 0 0 0 0 0 0
0072 _H	PUL2	Port 2 pull-up setting register	R/W	----0 0 0 0
0073 _H	PUL3	Port 3 pull-up setting register	R/W	-----0
0074 _H to 0079 _H	Access prohibited			
007A _H	FMCS	Flash memory control status register	R/W	0 0 0 0 0 0 - 0
007B _H	ILR1	Interrupt level setting register 1	W	1 1 1 1 1 1 1 1
007C _H	ILR2	Interrupt level setting register 2	W	1 1 1 1 1 1 1 1
007D _H	ILR3	Interrupt level setting register 3	W	1 1 1 1 1 1 1 1
007E _H	ILR4	Interrupt level setting register 3	W	1 1 1 1 1 1 1 1
007F _H	Access prohibited			

* : Only for MB89215, MB89F217, MB89P215

Description of write/read symbols :

- R/W : Read/write enabled
- R : Read only
- W : Write only

Description of initial values

- 0 : This bit initialized to "0".
- 1 : This bit initialized to "1".
- X : The initial value of this bit is undefined.
- : This bit is not defined.

Note : If a bit manipulation instruction accesses the serial mode register (SMR), a write-only register, or a register containing a write-only bit, the bit focused on by the instruction is set to a prescribed value but a malfunction occurs when the other bits contains a write-only bit. Do not use bit manipulation instructions to access such registers.

■ ELECTRICAL CHARACTERISTICS

1. Absolute Maximum Ratings

Parameter	Symbol	Rating		Unit	Remarks
		Min	Max		
Power supply voltage	V_{CC}	$V_{SS} - 0.3$	$V_{SS} + 6.0$	V	
Input voltage	V_I	$V_{SS} - 0.3$	$V_{CC} + 0.3$	V	*2
Output voltage	V_O	$V_{SS} - 0.3$	$V_{SS} + 6.0$	V	
Maximum clamp current	I_{CLAMP}	- 0.4	+ 0.4	mA	*1
Maximum clamp total current	$\Sigma I_{CLAMP} $	—	10	mA	*1
"L" level output current	I_{OL}	—	10	mA	
"L" level average current	I_{OLAV}	—	4	mA	Average value (operating current × operating duty)
"L" level total output current	ΣI_{OL}	—	50	mA	
"H" level output current	I_{OH}	—	- 10	mA	
"H" level average current	I_{OHAV}	—	- 4	mA	Average value (operating current × operating duty)
"H" level total output current	ΣI_{OH}	—	- 50	mA	
Power consumption	P_d	—	200	mW	MB89215, MB89P215
		—	300	mW	MB89F217
Storage temperature	T_{stg}	- 55	+ 150	°C	

*1 : • Applicable to pins : P00 to P07, P10 to P17, P20 to P23, P30 to P31

- Use within recommended operating conditions.
- Use at DC voltage (current) .
- The +B signal should always be applied with a limiting resistance placed between the +B signal and the microcontroller.
- The value of the limiting resistance should be set so that when the +B signal is applied the input current to the microcontroller pin does not exceed rated values, either instantaneously or for prolonged periods.
- Note that when the microcontroller drive current is low, such as in the power saving modes, the +B input potential may pass through the protective diode and increase the potential at the V_{CC} pin, and this may affect other devices.
- Note that if a +B signal is input when the microcontroller current is off (not fixed at 0 V), the power supply is provided from the pins, so that incomplete operation may result.
- Note that if the +B input is applied during power-on, the power supply is provided from the pins and the resulting supply voltage may not be sufficient to operate the power-on reset.
- Care must be taken not to leave the +B input pin open.
- Note that analog system input/output pins other than the A/D input pins (LCD drive pins, comparator input pins, etc.) cannot accept +B signal input.

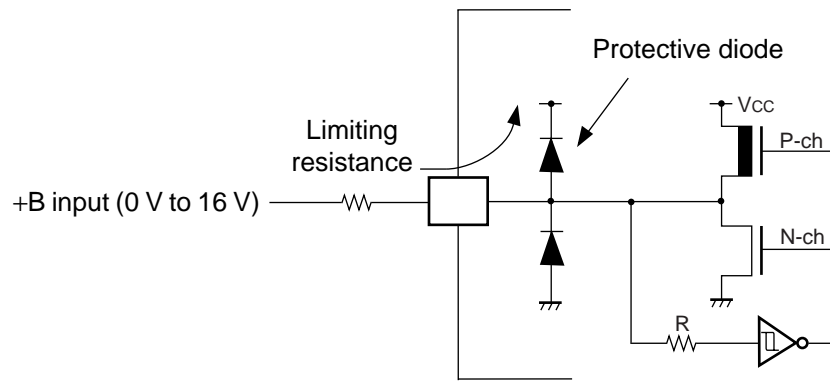
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MB89210 Series

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- Sample recommended circuits :

- Input/Output Equivalent circuits

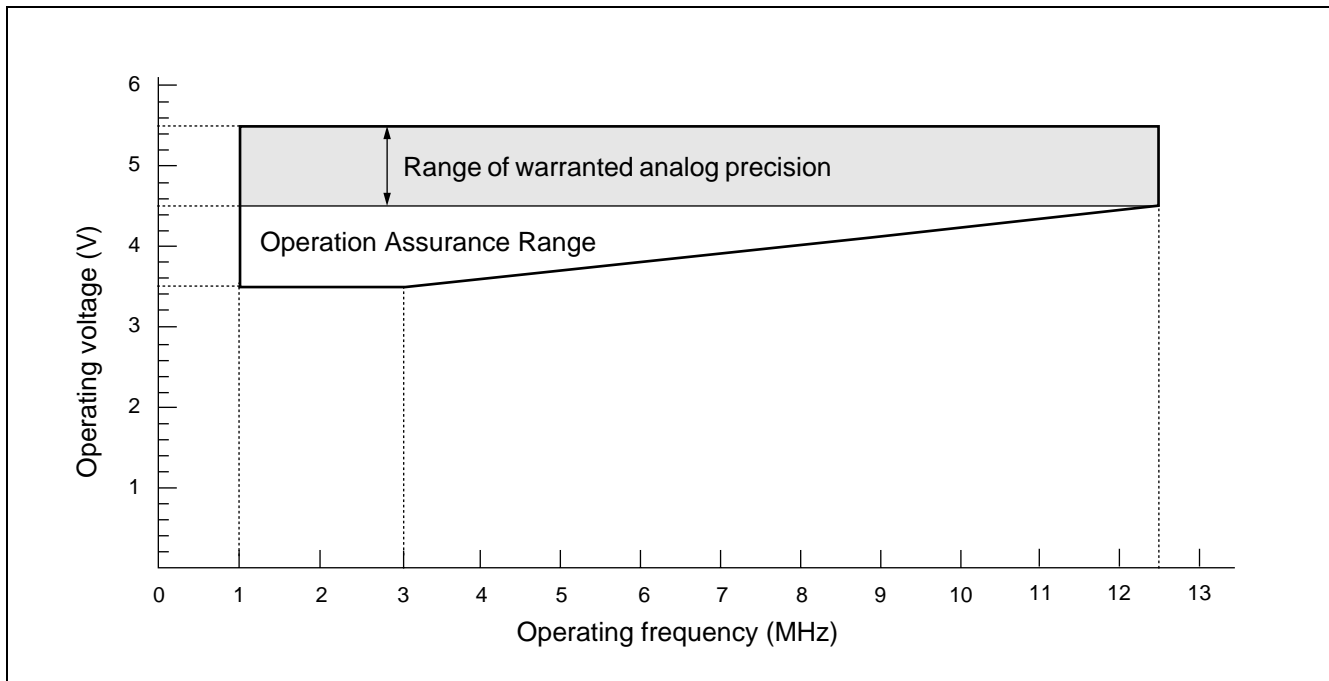


*2 : If the maximum current to/from an input is limited by some means with external components, the I_{CLAMP} rating supersedes the V_I rating.

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

Parameter	Symbol	Value		Unit	Remarks
		Min	Max		
Power supply voltage	V_{CC}	3.5	5.5	V	Normal Operation Assurance Range
		3.0	5.5	V	RAM status in stop mode
Input "H" voltage	V_{IH}	$0.7 V_{CC}$	$V_{CC} + 0.3$	V	P31,UI
	V_{IHS}	$0.8 V_{CC}$	$V_{CC} + 0.3$	V	MODA, MOD0, MOD1, \overline{RST} , P00 to P07, P10 to P17, P20 to P23, P30, INT0 to INT2, EC0, EC1, SCK, SI, UCK
Input "L" voltage	V_{IL}	$V_{SS} - 0.3$	$0.3 V_{CC}$	V	P31,UI
	V_{ILS}	$V_{SS} - 0.3$	$0.2 V_{CC}$	V	MODA, MOD0, MOD1, \overline{RST} , P00 to P07, P10 to P17, P20 to P23, P30, INT0 to INT2, EC0, EC1, SCK, SI, UCK
Operating temperature	T_a	- 40	+ 105	°C	



WARNING: The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device's electrical characteristics are warranted when the device is operated within these ranges.

Always use semiconductor devices within their recommended operating condition ranges. Operation outside these ranges may adversely affect reliability and could result in device failure.

No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their FUJITSU representatives beforehand.

MB89210 Series

3. DC Characteristics

($V_{CC} = 5.0\text{ V} \pm 10\%$, $V_{SS} = 0.0\text{ V}$, $F_{CH} = 10\text{ MHz}$ (external clock), $T_a = -40\text{ }^\circ\text{C}$ to $+105\text{ }^\circ\text{C}$)

Parameter	Symbol	Pin name	Condition	Value			Unit	Remarks	
				Min	Typ	Max			
“H” level input voltage	V_{IH}	P31, UI	—	$0.7 V_{CC}$	—	$V_{CC} + 0.3$	V		
	V_{IHS}	MODA, MOD0, MOD1, \overline{RST} , P00 to P07, P10 to P17, P20 to P23, P30, INT0 to INT2, EC0, EC1, SCK, SI, UCK	—	$0.8 V_{CC}$	—	$V_{CC} + 0.3$	V		
“L” level input voltage	V_{IL}	P31, UI	—	$V_{SS} - 0.3$	—	$0.3 V_{CC}$	V		
	V_{ILS}	MODA, MOD0, MOD1, \overline{RST} , P00 to P07, P10 to P17, P20 to P23, P30, INT0 to INT2, EC0, EC1, SCK, SI, UCK	—	$V_{SS} - 0.3$	—	$0.2 V_{CC}$	V		
“H” level output voltage	V_{OH}	P00 to P07, P10 to P17, P20 to P23, P30	$V_{CC} = 4.5\text{ V}$, $I_{OH} = -4.0\text{ mA}$	$V_{CC} - 0.5$	—	—	V		
“L” level output voltage	V_{OL}	P00 to P07, P10 to P17, P20 to P23, P30, \overline{RST}	$V_{CC} = 4.5\text{ V}$, $I_{OL} = 4.0\text{ mA}$	—	—	0.4	V		
Input leak current	I_{LI}	P00 to P07, P10 to P17, P20 to P23, P30, P31, MODA, MOD0, MOD1	$0.45\text{ V} < V_i < V_{CC}$	—	—	± 5	μA	Without pull-up resistance specified	
Pullup resistance	R_{PULL}	P00 to P07, P10 to P17, P20 to P23, P30, \overline{RST}	$V_i = 0.0\text{ V}$	25	50	100	$\text{k}\Omega$		
Power supply current	I_{CC}	V_{CC}	At normal operating (External clock, Max gear speed)	When A/D converter stops	—	8	12	mA	MB89215
					—	6	10	mA	MB89F217
					—	6	9	mA	MB89P215
			When A/D converter starts	—	11	15	mA	MB89215	
				—	8	13	mA	MB89F217	
				—	8	12	mA	MB89P215	
	I_{CCS}	V_{CC}	at sleep mode (External clock, Max gear speed)	When A/D converter stops	—	4	6	mA	MB89215
					—	3	5	mA	MB89F217, MB89P215
	I_{CCH}	V_{CC}	At stop mode $T_a = +25\text{ }^\circ\text{C}$ (External clock)	When A/D converter stops	—	—	1	μA	MB89215
				—	—	10	μA	MB89F217, MB89P215	
Input capacitance	C_{IN}	Other than V_{CC} and V_{SS}	—	—	5	15	pF	MB89F217, MB89P215	

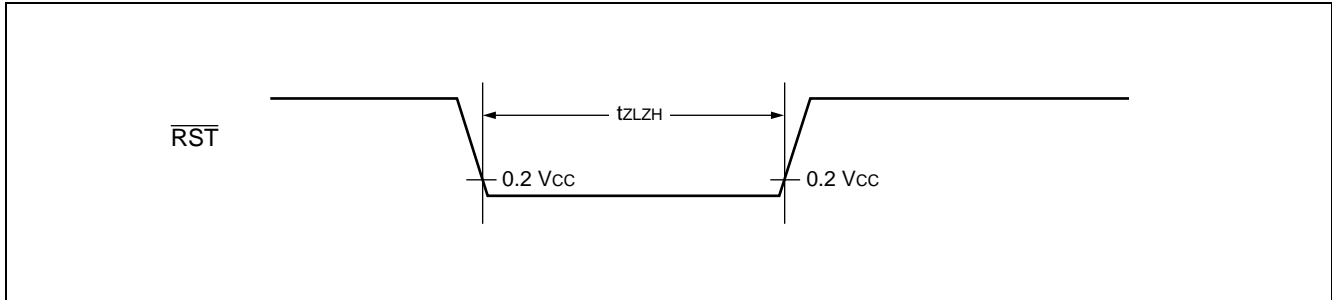
4. AC Characteristics

(1) Reset Timing

($V_{SS} = 0.0\text{ V}$, $T_a = -40\text{ }^\circ\text{C}$ to $+105\text{ }^\circ\text{C}$)

Parameter	Symbol	Condition	Value		Unit	Remarks
			Min	Max		
$\overline{\text{RST}}$ "L" level pulse width	t_{ZLZH}	—	48 t_{HCYL} *	—	ns	

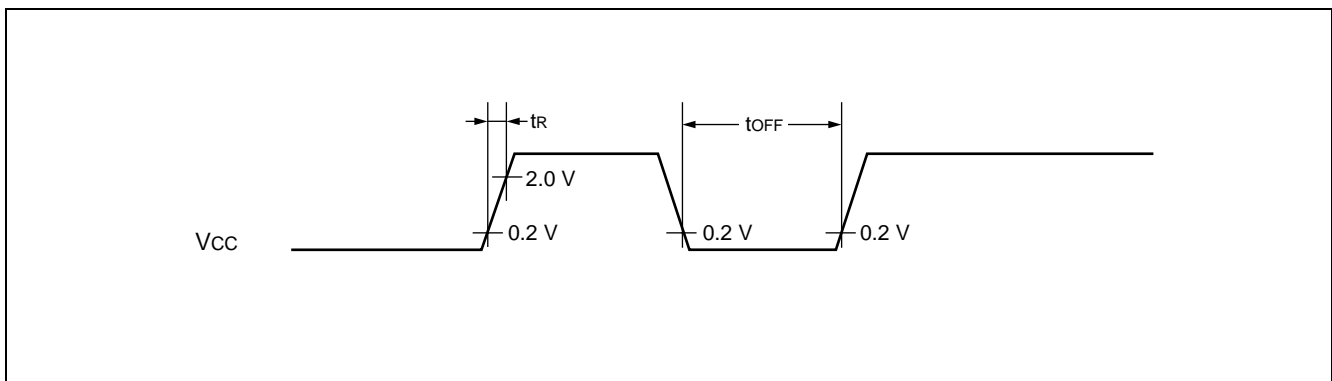
* : t_{HCYL} : Oscillation clock one cycle time



(2) Power-on reset

($V_{SS} = 0.0\text{ V}$, $T_a = -40\text{ }^\circ\text{C}$ to $+105\text{ }^\circ\text{C}$)

Parameter	Symbol	Condition	Value		Unit	Remarks
			Min	Max		
Power on time	t_{R}	—	—	50	ms	
Power shutoff time	t_{OFF}	—	1	—	ms	For repeated operation



Note : The supply voltage must be set to minimum value required for operation within the prescribed default oscillation setting time.

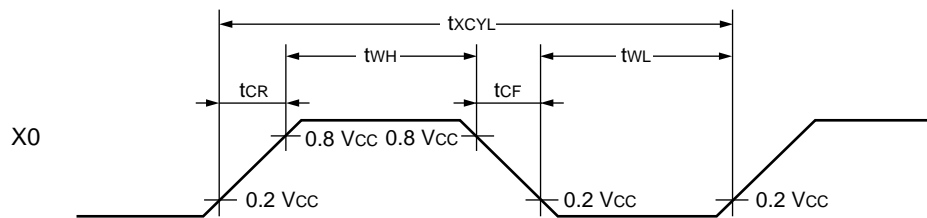
MB89210 Series

(3) Clock Timing

($V_{SS} = 0.0\text{ V}$, $T_a = -40\text{ }^\circ\text{C}$ to $+105\text{ }^\circ\text{C}$)

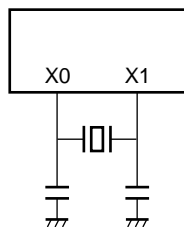
Parameter	Symbol	Condition	Value		Unit	Remarks
			Min	Max		
Clock frequency	F_{CH-1}	Crystal or ceramic oscillation	1	12.5	MHz	
Clock cycle time	t_{CYL}		80	1000	ns	
Input clock pulse width	t_{WH} t_{WL}		20	—	ns	
Input clock rise, fall time	t_{CR} t_{CF}		—	10	ns	
Oscillation frequency	F_{CH-2}	CR(built-in) oscillator	8.5	11.5	MHz	

• X0 and X1 Timing and application Conditions

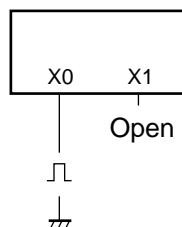


• Clock application Conditions

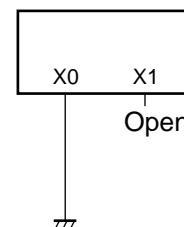
Using crystal oscillator
or
ceramic oscillator



Using external clock



Using CR (built-in)
oscillator



(4) Instruction Cycle

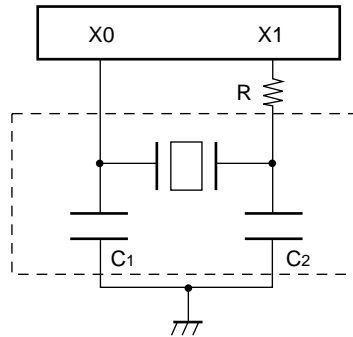
($V_{SS} = 0.0\text{ V}$, $T_a = -40\text{ }^\circ\text{C}$ to $+105\text{ }^\circ\text{C}$)

Parameter	Symbol	Value	Unit	Remarks
Instruction cycle (instruction execution time)	t_{INST}	$4/F_{CH}$, $8/F_{CH}$, $16/F_{CH}$, $64/F_{CH}$	μs	When operating at $F_{CH} = 10\text{ MHz}$ $t_{INST} = 0.4\text{ }\mu\text{s}$ ($4/F_{CH}$)

F_{CH} : Oscillation frequency (Operating clock frequency after switching between external and CR (internal) oscillator clocks)

(5) Recommended Resonator Manufactures

- Sample application of ceramic resonator



Resonator manufacture	Resonator	Frequency (MHz)	C ₁	C ₂	R
Murata Mfg. Co., Ltd.	CSTLS4M00G56-B0	4.00	built-in	built-in	680 Ω
	CSTCR4M00G55-R0	4.00	built-in	built-in	680 Ω
	CSTLS8M00G53-B0	8.00	built-in	built-in	—
	CSTCC8M00G53-R0	8.00	built-in	built-in	—
	CSTLS10M0G53-B0	10.00	built-in	built-in	—
	CSTCC10M00G53-R0	10.00	built-in	built-in	—

Inquiry : • Murata Electronics North America Inc : TEL +1-404-436-1300
 • Murata Europe Management GmbH : TEL +49-911-66870
 • Murata Electronics Singapore (p/e) : TEL +65-758-4233

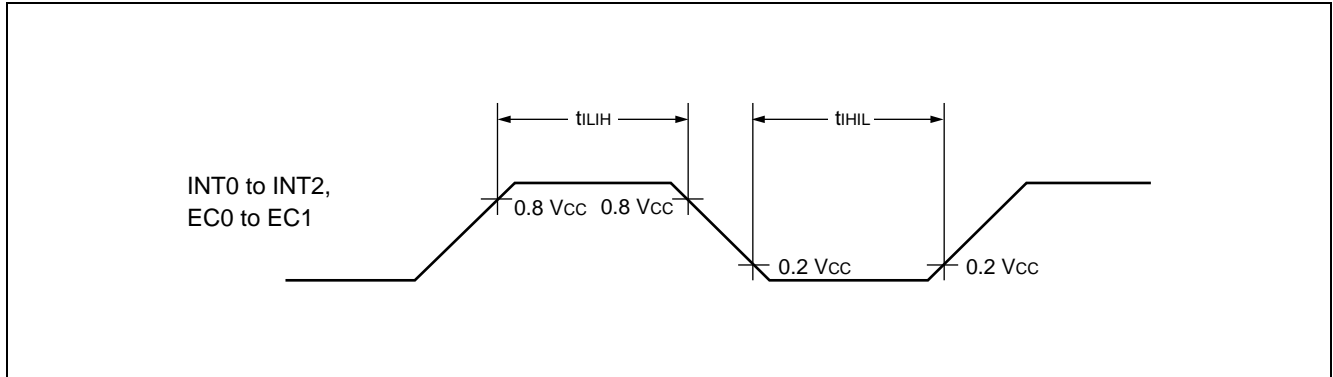
MB89210 Series

(6) Peripheral Input Timing

($V_{CC} = 5.0\text{ V} \pm 10\%$, $V_{SS} = 0.0\text{ V}$, $T_a = -40\text{ }^\circ\text{C}$ to $+105\text{ }^\circ\text{C}$)

Parameter	Symbol	Pin name	Value		Unit	Remarks
			Min	Max		
Peripheral input "H" pulse width	t_{LH}	INT0 to INT2, EC0, EC1	$2 t_{INST}^*$	—	μs	
Peripheral input "L" pulse width	t_{HL}	INT0 to INT2, EC0, EC1	$2 t_{INST}^*$	—	μs	

*: For t_{INST} see "(4) Instruction Cycle".



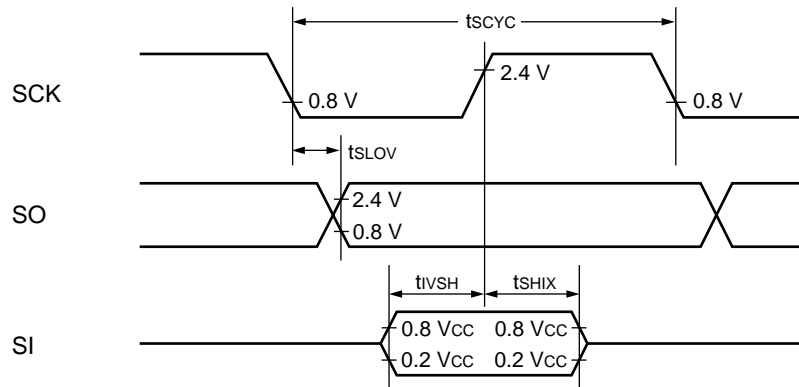
(7) Serial I/O Timing

($V_{CC} = 5.0\text{ V} \pm 10\%$, $V_{SS} = 0.0\text{ V}$, $T_a = -40\text{ }^\circ\text{C}$ to $+105\text{ }^\circ\text{C}$)

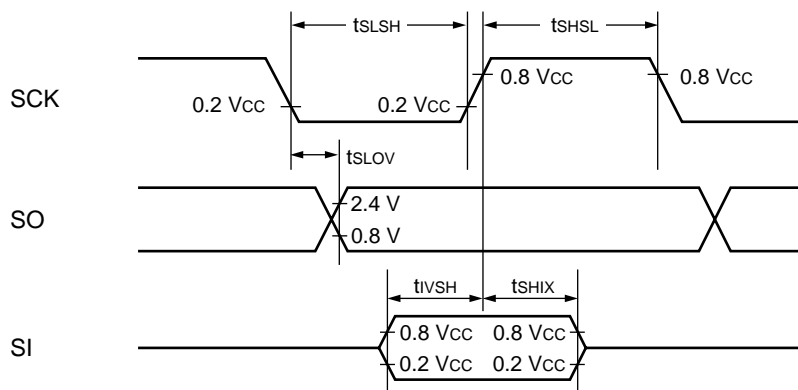
Parameter	Symbol	Pin name	Condition	Value		Unit	Remarks
				Min	Max		
Serial clock cycle time	t_{SCYC}	SCK	Internal clock operation	$2 t_{INST}^*$	—	μs	
SCK $\downarrow \rightarrow$ SO time	t_{SLOV}	SCK, SO		-200	200	ns	
Valid SI \rightarrow SCK \uparrow	t_{IVSH}	SCK, SI		$0.5 t_{INST}^*$	—	μs	
SCK $\uparrow \rightarrow$ Valid SI hold time	t_{SHIX}	SCK, SI		$0.5 t_{INST}^*$	—	μs	
Serial clock "H" pulse width	t_{SHSL}	SCK	External clock operation	t_{INST}^*	—	μs	
Serial clock "L" pulse width	t_{SLSH}	SCK		t_{INST}^*	—	μs	
SCK $\downarrow \rightarrow$ SO time	t_{SLOV}	SCK, SO		0	200	ns	
Valid SI \rightarrow SCK \uparrow	t_{IVSH}	SCK, SI		$0.5 t_{INST}^*$	—	μs	
SCK $\uparrow \rightarrow$ Valid SI hold time	t_{SHIX}	SCK, SI	$0.5 t_{INST}^*$	—	μs		

*: For t_{INST} see "(4) Instruction Cycle".

• Internal shift clock mode



• External shift clock mode



MB89210 Series

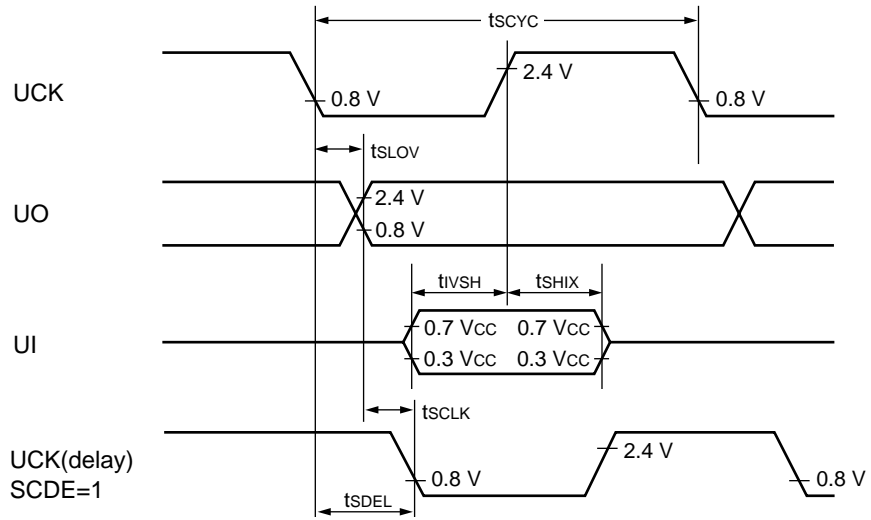
(8) LIN-UART timing

($V_{CC} = 5.0\text{ V} \pm 10\%$, $V_{SS} = 0.0\text{ V}$, $T_a = -40\text{ }^\circ\text{C}$ to $+105\text{ }^\circ\text{C}$)

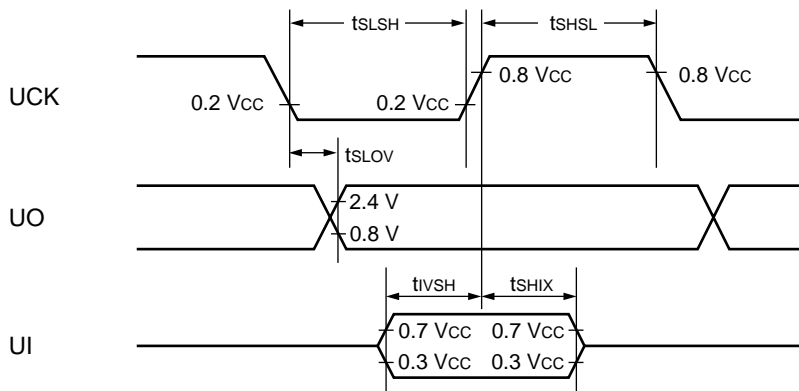
Parameter	Symbol	Pin name	Condition	Value		Unit	Remarks
				Min	Max		
Serial clock cycle time	t_{SCYC}	UCK	Internal clock operation	$2 t_{INST}^*$	—	μs	
UCK $\downarrow \rightarrow$ UO time	t_{SLOV}	UCK, UO		- 200	200	ns	
Valid UI \rightarrow UCK \uparrow	t_{IVSH}	UCK, UI		$0.5 t_{INST}^*$	—	μs	
UCK $\uparrow \rightarrow$ Valid UI hold time	t_{SHIX}	UCK, UI		0	—	μs	
UCK $\downarrow \rightarrow$ UO time	t_{SLOV}	UCK, UO		- 200	200	ns	SCDE = 1
UCK (delay) $\downarrow \rightarrow$ UO time	t_{SCLK}	UCK (delay), UO		$-0.5 t_{INST}^*$	—	μs	SCDE = 1
UCK $\downarrow \rightarrow$ UCK (delay) \downarrow	t_{SDEL}	UCK, UCK (delay)		$0.5 t_{INST}^*$	—	μs	SCDE = 1
Serial clock "H" pulse width	t_{SHSL}	UCK	External clock operation	$1.5 t_{INST}^*$	—	μs	
Serial clock "L" pulse width	t_{SLSH}	UCK		$1.5 t_{INST}^*$	—	μs	
UCK $\downarrow \rightarrow$ UO time	t_{SLOV}	UCK, UO		t_{INST}^*	—	μs	
Valid UI \rightarrow UCK \uparrow	t_{IVSH}	UCK, UI		0	—	μs	
UCK $\uparrow \rightarrow$ Valid UI hold time	t_{SHIX}	UCK, UI		$0.5 t_{INST}^*$	—	μs	

*: For t_{INST} see "(4) Instruction Cycle".

- Internal shift clock mode



- External shift clock mode



MB89210 Series

5. A/D Converter

(1) A/D converter electrical characteristics

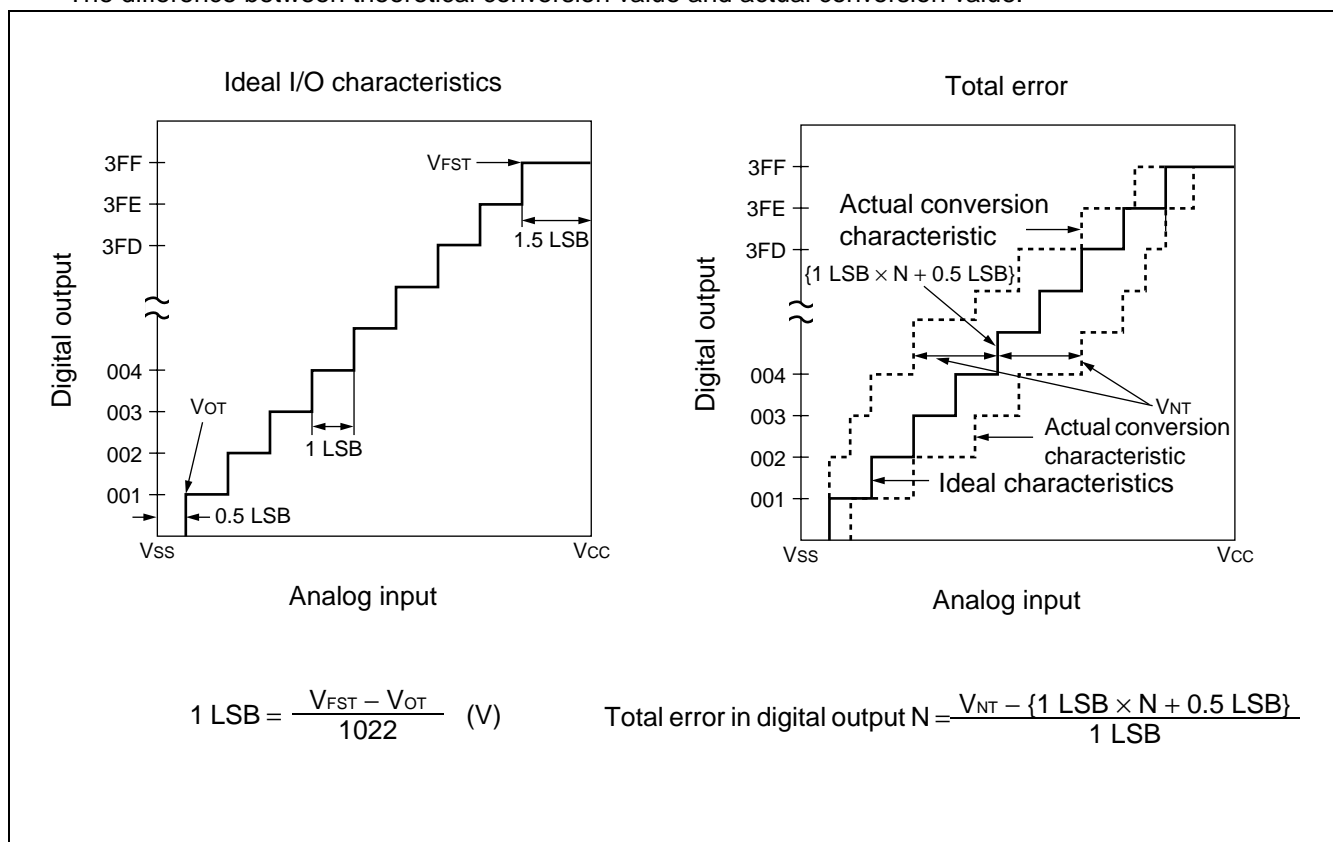
($V_{CC} = 5.0\text{ V} + 10\%$, $V_{SS} = 0.0\text{ V}$, $T_a = -40\text{ }^{\circ}\text{C}$ to $+105\text{ }^{\circ}\text{C}$)

Parameter	Symbol	Value			Unit	Remarks
		Min	Typ	Max		
Resolution	—	—	—	10	bit	
Total error		- 5.0	—	+ 5.0	LSB	
Linearity error		- 3.0	—	+ 3.0	LSB	
Differential linear error		- 2.5	—	+ 2.5	LSB	
Zero transition voltage	V_{OT}	$V_{SS} - 3.5\text{ LSB}$	$V_{SS} + 0.5\text{ LSB}$	$V_{SS} + 4.5\text{ LSB}$	V	
Full-scale transition voltage	V_{FST}	$V_{CC} - 6.5\text{ LSB}$	$V_{CC} - 1.5\text{ LSB}$	$V_{CC} + 2.0\text{ LSB}$	V	
A/D mode conversion time	—	—	—	$38\ t_{INST}^*$	μs	
Analog input current	I_{AIN}	—	—	10	μA	
Analog input voltage range	—	0	—	V_{CC}	V	

* : For t_{INST} see “ (4) Instruction Cycle” in “4. AC Characteristics”.

(2) Definition of A/D Converter Terms

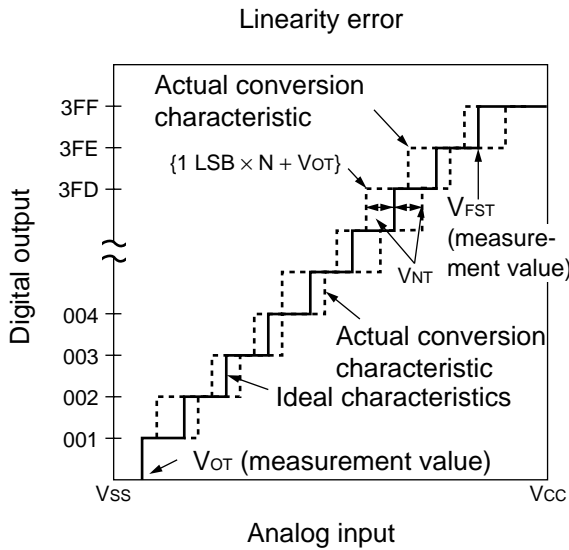
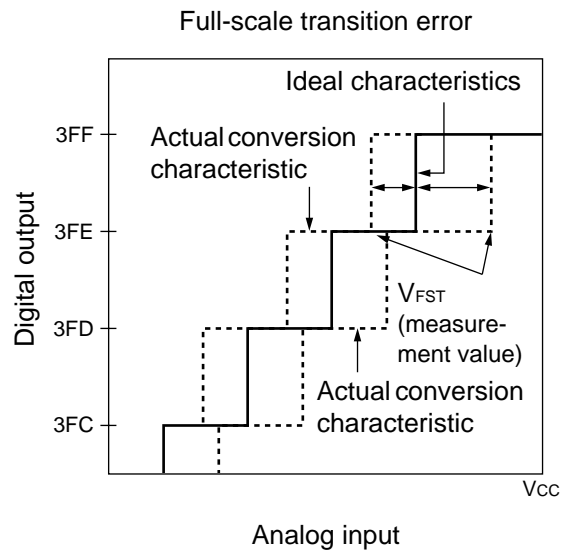
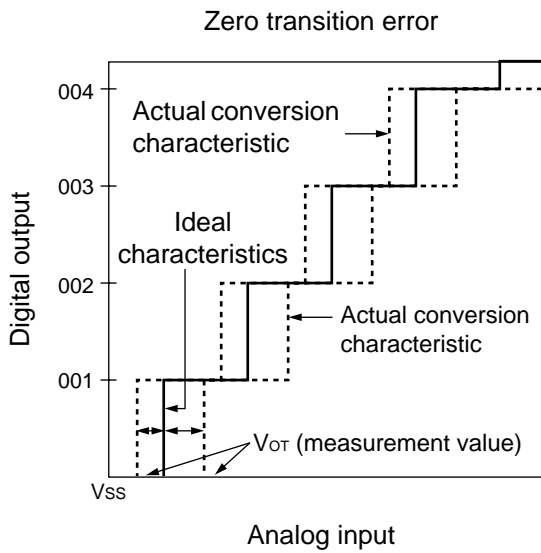
- Resolution
The level of analog variation that can be distinguished by the A/D converter.
When the number of bits is 10, analog voltage can be divided into $2^{10} = 1024$.
- Linear error (Unit : LSB)
The deviation between the value along a straight line connecting the zero transition point ("00 0000 0000" ←→ "00 0000 0001") of a device and the full-scale transition point ("11 1111 1111" ←→ "11 1111 1110"), compared with the actual conversion values obtained.
- Differential linear error (Unit : LSB)
Deviation of input voltage, which is required for changing output code by 1 LSB, from an ideal value.
- Total error (Unit : LSB)
The difference between theoretical conversion value and actual conversion value.



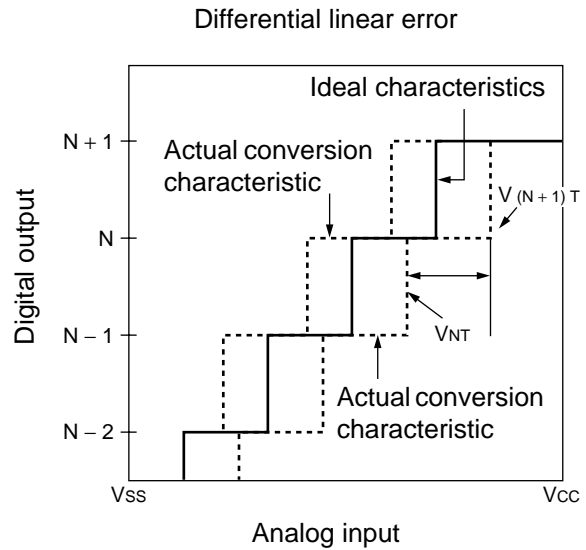
(Continued)

MB89210 Series

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



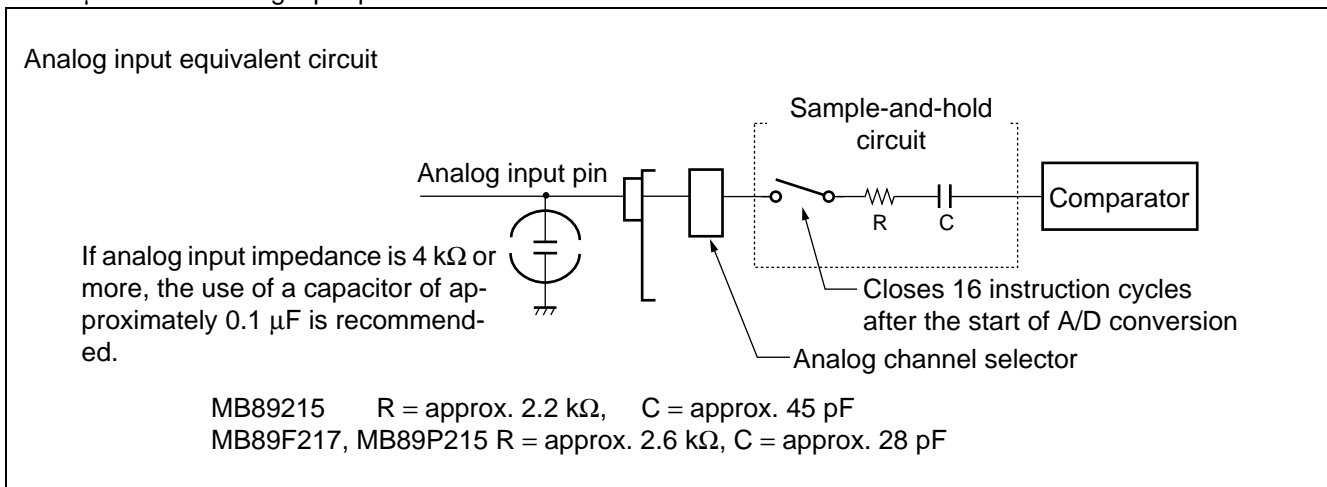
$$\text{Differential linear error in digital output } N = \frac{V_{(N+1)T} - V_{NT}}{1 \text{ LSB}} - 1$$

(3) Precautionary Information of A/D conversion

- Input Impedance of Analog Input Pins

The A/D converter has a sample & hold circuit as shown below, which uses a sample-and-hold capacitor to obtain the voltage at the analog input pin for 16 instruction cycles following the start of A/D conversion. For this reason if the external circuits providing the analog input signal have high output impedance, the analog input voltage may not stabilize within the analog input sampling time. It is therefore recommended that the output impedance of external circuits be reduced to 4 k Ω or less.

Note that if the impedance cannot be kept low, it is recommended to connect an external capacitor of about 0.1 μ F for the analog input pin.



- About errors

The smaller the absolute value $|V_{CC} - V_{SS}|$ is, the greater the relative error becomes.

MB89210 Series

6. Electrical Characteristics of Flash Memory

- Programming and erasing characteristics

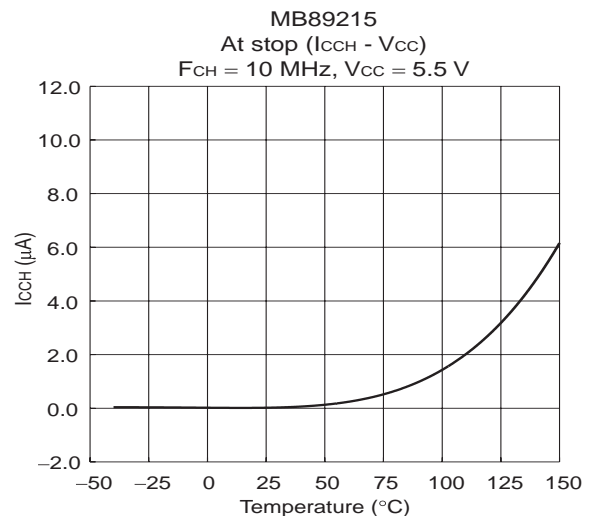
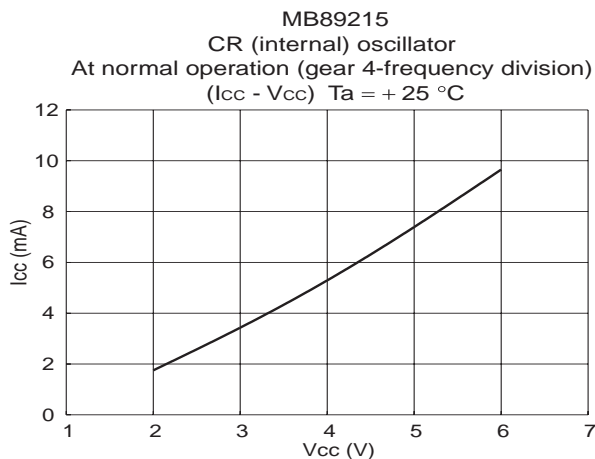
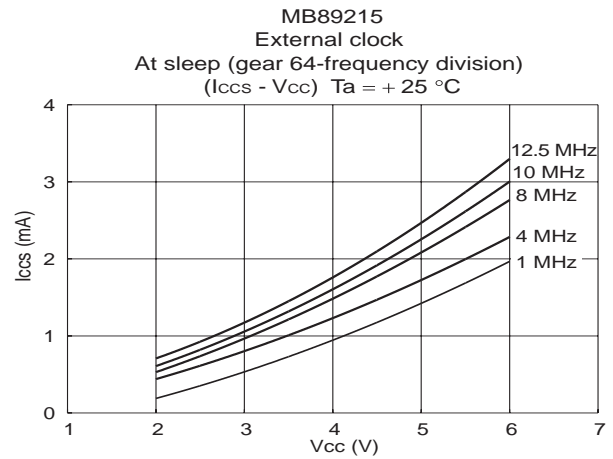
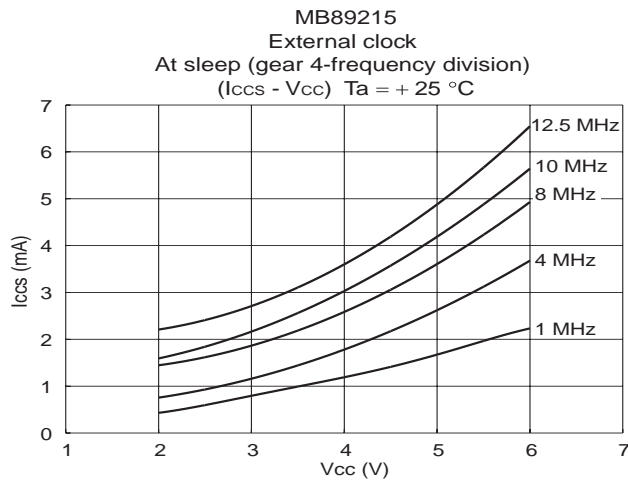
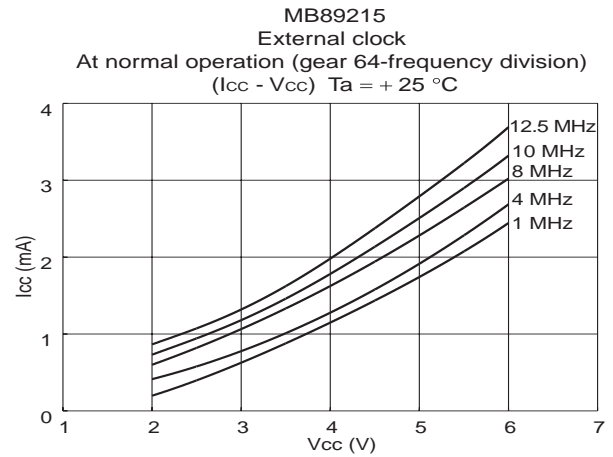
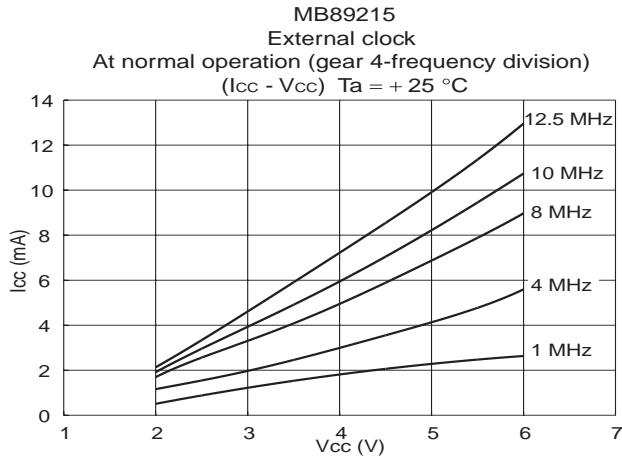
Parameter			Symbol	Pin Name	Condition	Value			Unit	Remarks
						Min	Typ	Max		
Power supply current *1			I _{FWE}	V _{CC}	V _{CC} = 5.0 V	—	—	40	mA	
Sector erase time	Per 1 sector, constant value independent with sector capacitance	Successful completion time	—	—	—	—	1	15	s	
		Unsuccessful completion time	—	—	—	—	—	*2	—	
Programming time	Per 1 byte	Successful completion time	—	—	—	—	8	3600	μs	
		Unsuccessful completion time	—	—	—	—	650	3600	μs	

*1 : Embedded Algorithm executing.

*2 : If a fault occurs during sector erasing, detection via DQ₅ may not be available (DQ₅ = 1 may not occur) . Accordingly, a fault must be assumed after 15 s, even if DQ₅ does not go to “1”.

EXAMPLE CHARACTERISTICS

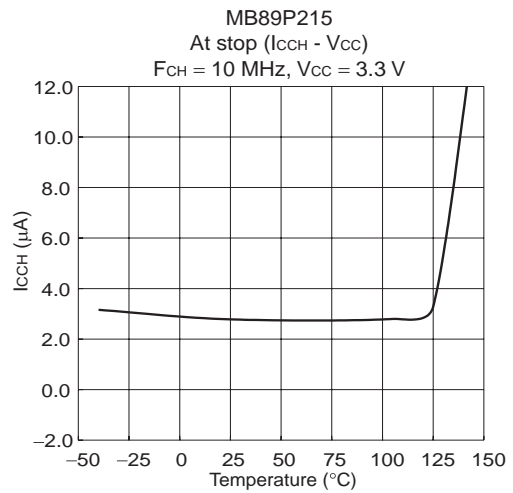
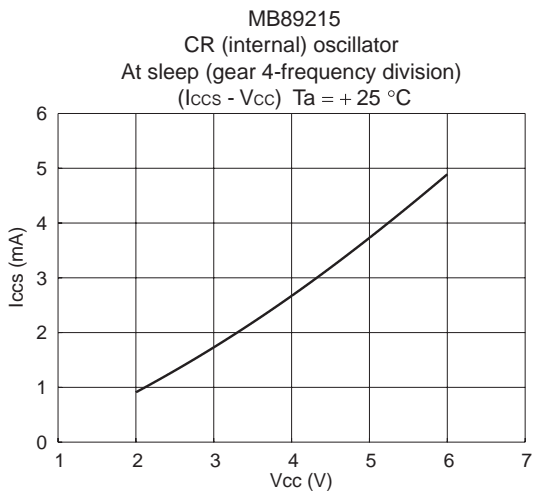
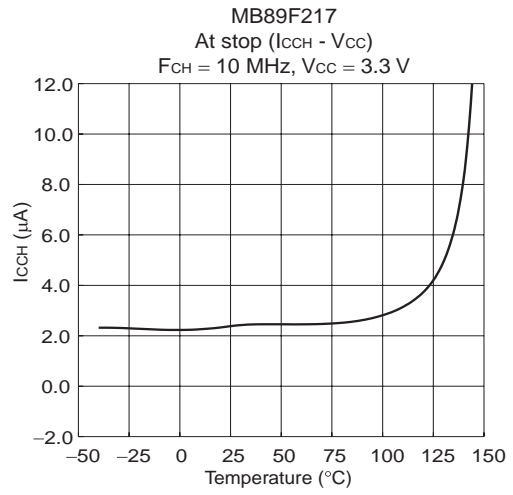
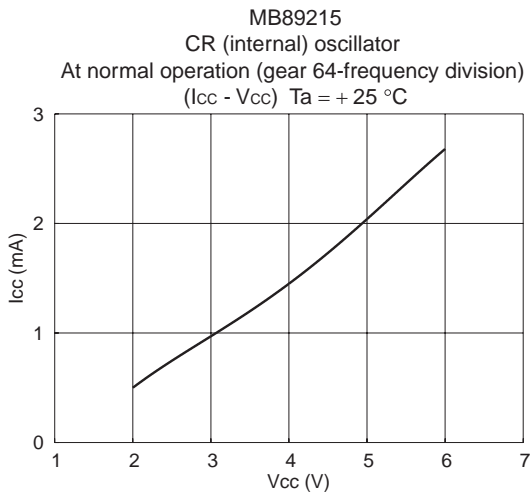
(1) Power Supply Current



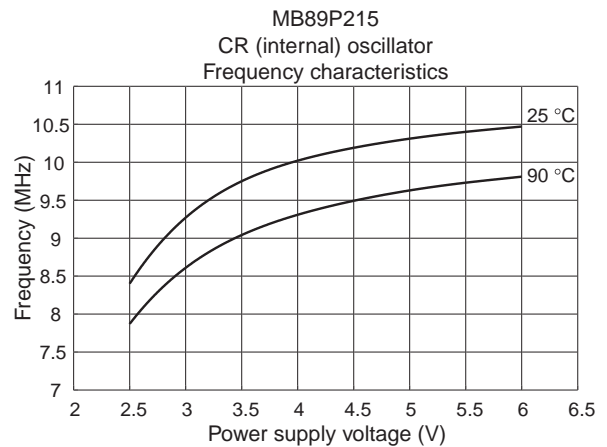
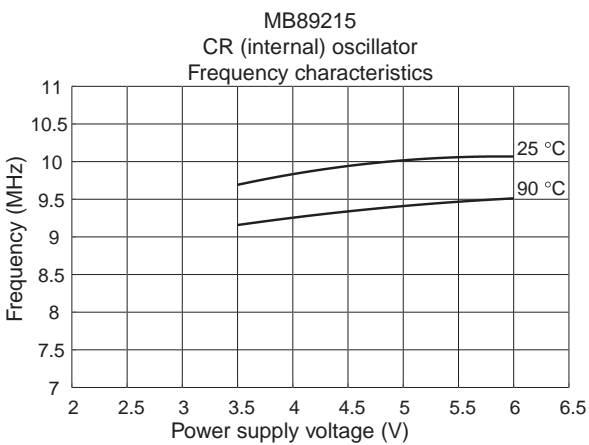
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MB89210 Series

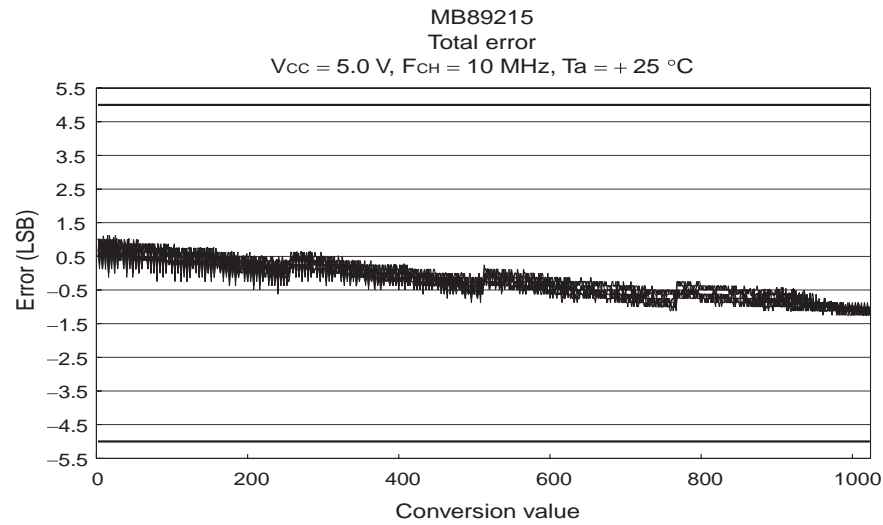
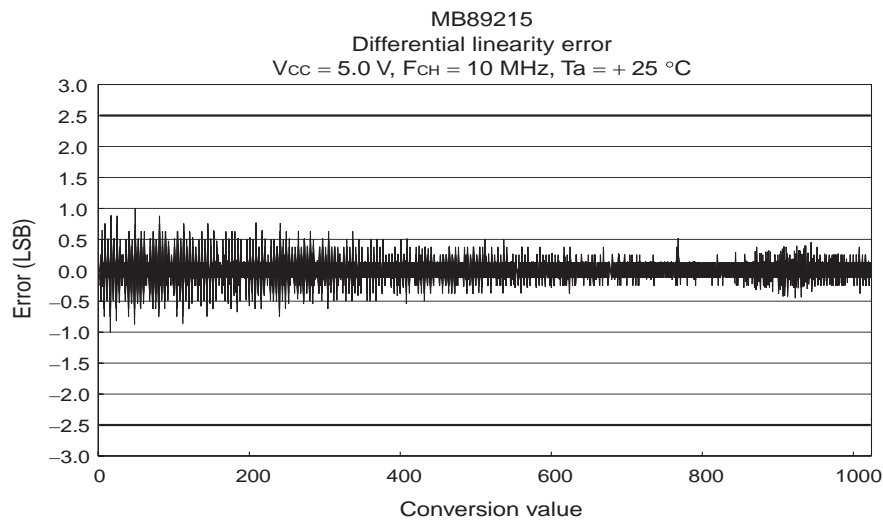
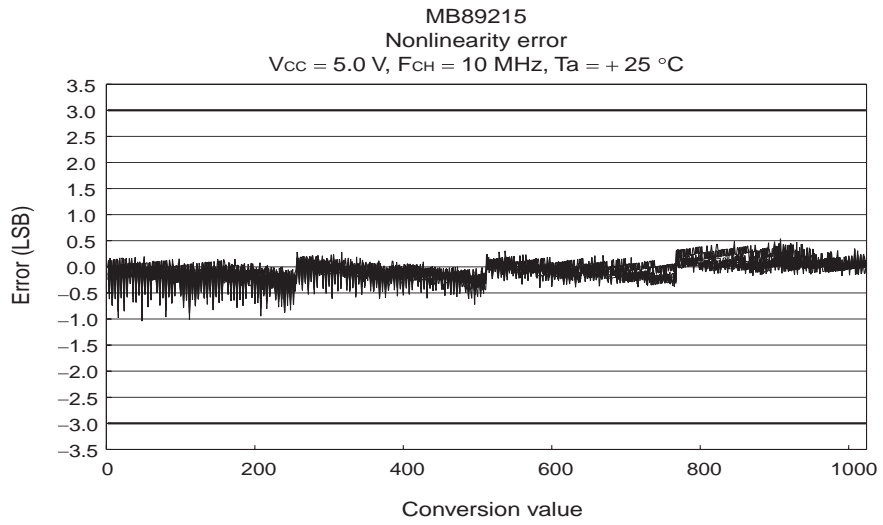
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(2) Frequency Characteristics



(3) AD Converter Characteristics Example



MB89210 Series

■ MASK OPTIONS

No	Part number	MB89215	MB89F217	MB89P215	MB89PV210
	Specifying procedure	Setting disallowed			
1	Initial value* selection of internal clock oscillation stabilization wait time (at $F_{CH} = 10 \text{ MHz}$) <ul style="list-style-type: none"> • 01 : $2^{14}/F_{CH}$ (Approx. 1.63 ms) • 10 : $2^{17}/F_{CH}$ (Approx. 13.1 ms) • 11 : $2^{18}/F_{CH}$ (Approx. 26.2 ms) 	$2^{18}/F_{CH}$ (Approx. 26.2 ms)			
2	Power-on reset <ul style="list-style-type: none"> • Power-on reset ON • Power-on reset OFF 	Yes			
3	Reset pin output <ul style="list-style-type: none"> • Reset output ON • Reset output OFF 	Yes			

F_{CH} : Base oscillator

* : Initial value to which the oscillation setting time bit (sync : WT1, WT0) in the system clock control register is set.

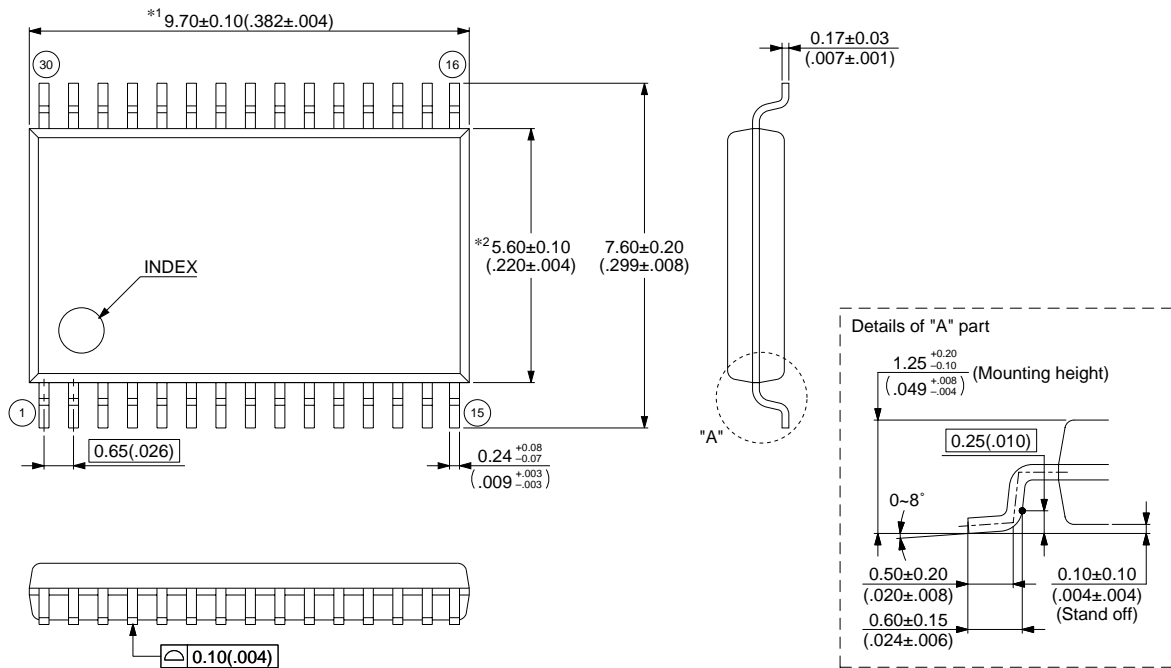
■ ORDERING INFORMATION

Part number	Package	Remarks
MB89215PFV MB89P215PFV	30-pin Plastic SSOP (FPT-30P-M02)	
MB89215PFM MB89F217PFM	48-pin Plastic QFP (FPT-48P-M13)	
MB89PV210CF	48-pin Ceramic MQFP (MQP-48C-P02)	

PACKAGE DIMENSIONS

30-pin Plastic SSOP
(FPT-30P-M02)

- Note 1) *1 : Resin protrusion. (Each side +0.15 (.006) Max) .
- Note 2) *2 : These dimensions do not include resin protrusion.
- Note 3) Pins width and pins thickness include plating thickness.
- Note 4) Pins width do not include tie bar cutting remainder.



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Dimensions in mm (inches)

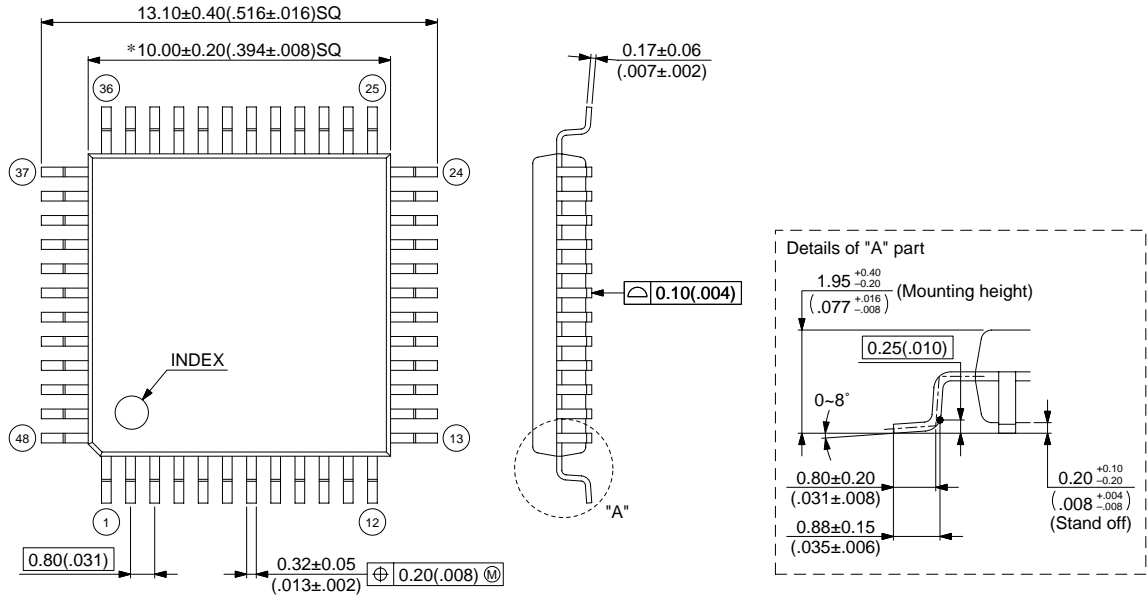
Note : The values in parentheses are reference values.

(Continued)

MB89210 Series

48-pin plastic QFP
(FPT-48P-M13)

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



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Dimensions in mm (inches)

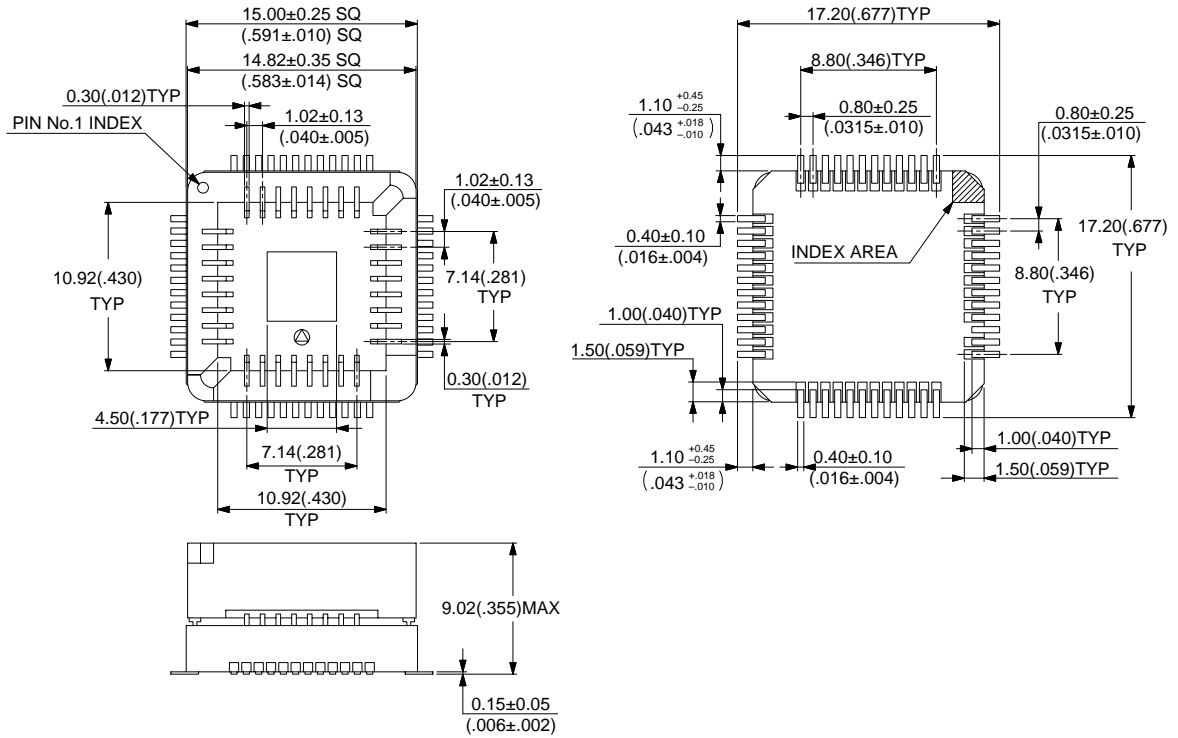
Note : The values in parentheses are reference values.

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MB89210 Series

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48-pin Ceramic MQFP
(MQP-48C-P02)



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Dimensions in mm (inches)

Note : The values in parentheses are reference values.

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