

32-bit Proprietary Microcontroller

CMOS

FR60Lite MB91265 Series

MB91266/MB91F267

■ DESCRIPTION

The MB91265 series is a 32-bit RISC microcontroller designed by Fujitsu for embedded control applications which require high-speed processing.

The CPU is used the FR family and the compatibility of FR60Lite.

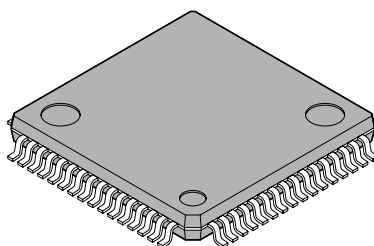
■ FEATURES

- FR60Lite CPU
 - 32-bit RISC, load/store architecture with a five-stage pipeline
 - Maximum operating frequency : 33 MHz (oscillation frequency 4.192 MHz, oscillation frequency 8-multiplier (PLL clock multiplication method))
 - 16-bit fixed length instructions (basic instructions)
 - Execution speed of instructions : 1 instruction per cycle
 - Memory-to-memory transfer, bit handling, barrel shift instructions, etc : Instructions suitable for embedded applications
 - Function entry/exit instructions, multiple-register load/store instructions : Instructions adapted for C-language

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■ PACKAGE

64-pin plastic LQFP



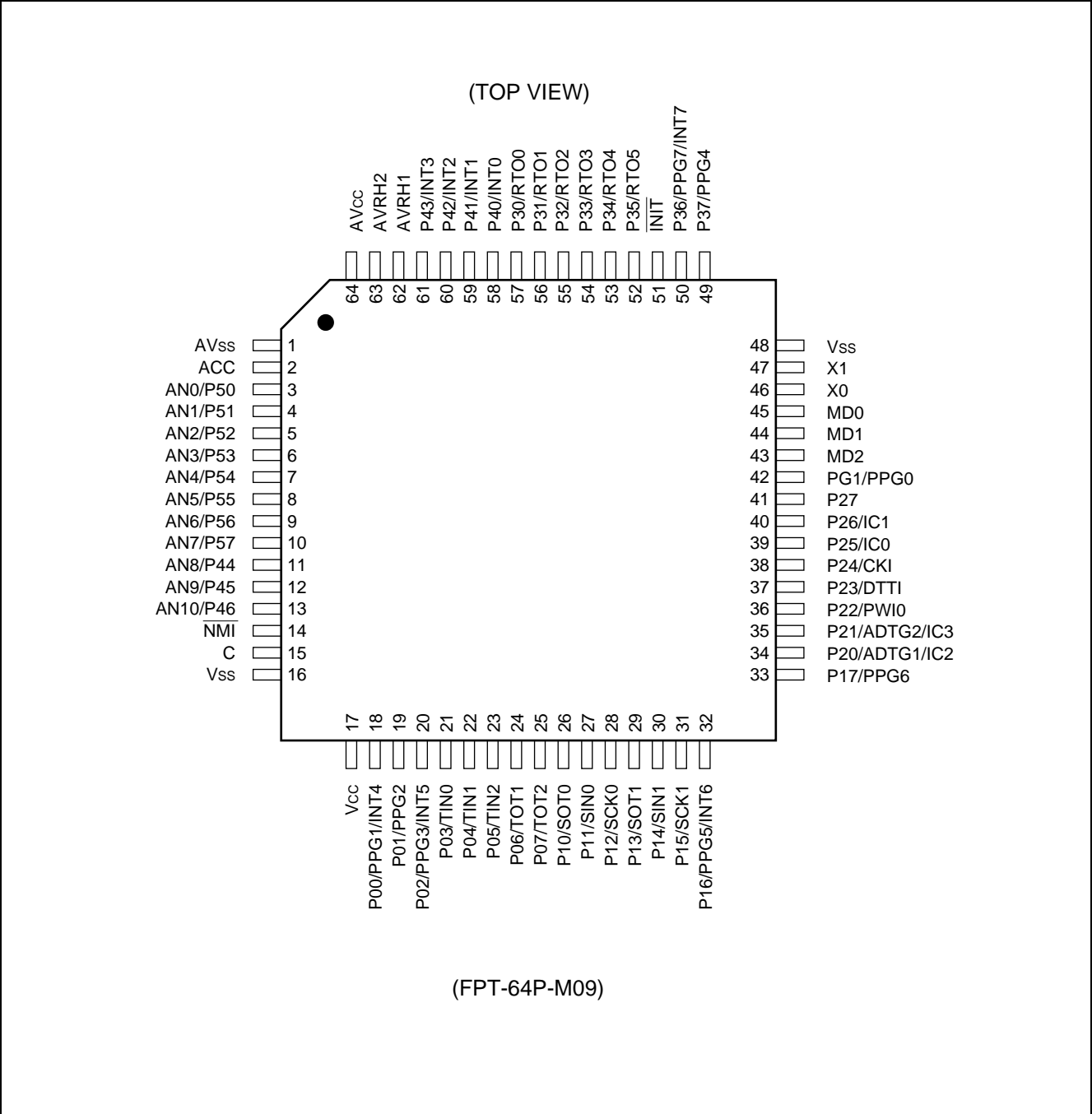
(FPT-64P-M09)

MB91265 Series

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- Register interlock function : Facilitates coding in assembler.
- Built-in multiplier with instruction-level support
 - 32-bit multiplication with sign : 5 cycles
 - 16-bit multiplication with sign : 3 cycles
- Interrupt (PC, PS save) : 6 cycles, 16 priority levels
- Harvard architecture allowing program access and data access to be executed simultaneously
- Instruction compatible with FR family
- Internal peripheral functions
 - Capacity of internal ROM and ROM type
MASK ROM : 64 Kbytes (MB91266)
FLASH ROM : 128 Kbytes (MB91F267)
 - Capacity of internal RAM : 2 Kbytes (MASK product)/4 Kbytes (FLASH product)
 - A/D converter (sequential comparison type)
 - External interrupt input : 8 channels
 - Bit search module (for REALOS)
Function for searching the MSB (upper bit) in each word for the first 1-to-0 inverted bit position
 - UART (Full-duplex double buffer) : 2 channels
Selectable parity On/Off
Asynchronous (start-stop synchronized) or clock-synchronous communications selectable
Internal timer for dedicated baud rate (U-Timer) on each channel
External clock can be used as transfer clock
Error detection function for parity, frame, and overrun errors
 - 8/16-bit PPG timer : 8 channels (at 8-bit) / 4 channels (at 16-bit)
 - Timing generator
 - 16-bit reload timer : 3 channels (with cascade mode, without output of reload timer 0)
 - 16-bit free-run timer : 3 channels
 - 16-bit PWC timer : 1 channel
 - Input capture : 4 channels (interface with free-run timer)
 - Output compare : 6 channels (interface with free-run timer)
 - Waveform generator
Various waveforms which are generated by using output compare, 16-bit PPG timer 0, and 16-bit dead timer
 - SUM of products macro
RAM : instruction RAM (I-RAM) 256 × 16-bit
X-RAM 64 × 16-bit
Y-RAM 64 × 16-bit
Execution of 1 cycle MAC (16-bit × 16-bit + 40 bits)
Operation results are extracted rounded from 40 to 16 bits
 - DMAC (DMA Controller) : 5 channels
Operation of transfer and activation by internal peripheral interrupts and software
 - Watchdog timer
 - Low-power consumption mode
Sleep/stop function
 - Package : LQFP-64P
 - Technology : CMOS 0.35 μm
 - Power supply : 1-power supply (Vcc = 4.0 V to 5.5 V)

PIN ASSIGNMENT



MB91265 Series

■ PIN DESCRIPTION

Pin no.	Pin name	Circuit type	Description
3	AN0	G	Analog input terminal of A/D converter 1. This function becomes valid when set the corresponding AICR1 register to analog input.
	P50		General purpose input/output port. This function becomes valid when analog input is set to disabled.
4	AN1	G	Analog input terminal of A/D converter 1. This function becomes valid when set the corresponding AICR1 register to analog input.
	P51		General purpose input/output port. This function becomes valid when analog input is set to disabled.
5	AN2	G	Analog input terminal of A/D converter 1. This function becomes valid when set the corresponding AICR1 register to analog input.
	P52		General purpose input/output port. This function becomes valid when analog input is set to disabled.
6	AN3	G	Analog input terminal of A/D converter 1. This function becomes valid when set the corresponding AICR1 register to analog input.
	P53		General purpose input/output port. This function becomes valid when analog input is set to disabled.
7	AN4	G	Analog input terminal of A/D converter 2. This function becomes valid when set the corresponding AICR2 register to analog input.
	P54		General purpose input/output port. This function becomes valid when analog input is set to disabled.
8	AN5	G	Analog input terminal of A/D converter 2. This function becomes valid when set the corresponding AICR2 register to analog input.
	P55		General purpose input/output port. This function becomes valid when analog input is set to disabled.
9	AN6	G	Analog input terminal of A/D converter 2. This function becomes valid when set the corresponding AICR2 register to analog input.
	P56		General purpose input/output port. This function becomes valid when analog input is set to disabled.
10	AN7	G	Analog input terminal of A/D converter 2. This function becomes valid when set the corresponding AICR2 register to analog input.
	P57		General purpose input/output port. This function becomes valid when analog input is set to disabled.
11	AN8	G	Analog input terminal of A/D converter 2. This function becomes valid when set the corresponding AICR2 register to analog input.
	P44		General purpose input/output port. This function becomes valid when analog input is set to disabled.
12	AN9	G	Analog input terminal of A/D converter 2. This function becomes valid when set the corresponding AICR2 register to analog input.
	P45		General purpose input/output port. This function becomes valid when analog input is set to disabled.

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Pin no.	Pin name	Circuit type	Description
13	AN10	G	Analog input terminal of A/D converter 2. This function becomes valid when set the corresponding AICR2 register to analog input.
	P46		General purpose input/output port. This function becomes valid when analog input is set to disabled.
14	$\overline{\text{NMI}}$	H	NMI (Non Maskable Interrupt) input terminal.
18	INT4	E	External interrupt input terminal. Since this input is used as required while the corresponding external interrupt is enabled, the port output must remain off unless intentionally used.
	PPG1		Output terminal of PPG timer 1. This function becomes valid when output of PPG timer 1 is set to enabled.
	P00		General purpose input/output port. This function becomes valid when output of PPG timer 1 and external interrupt input are set to disabled.
19	PPG2	D	Output terminal of PPG timer 2. This function becomes valid when output of PPG timer 2 is set to enabled.
	P01		General purpose input/output port. This function becomes valid when output of PPG timer 2 is set to disabled.
20	INT5	E	External interrupt input terminal. Since this input is used as required while the corresponding external interrupt is enabled, the port output must remain off unless intentionally used.
	PPG3		Output terminal of PPG timer 3. This function becomes valid when output of PPG timer 3 is set to enabled.
	P02		General purpose input/output port. This function becomes valid when output of PPG timer 3 and external interrupt input are set to disabled.
21	TIN0	D	External trigger input terminal of reload timer 0. Since this input is used as required while the trigger input is enabled, the port output must remain off unless intentionally used.
	P03		General purpose input/output port. This function becomes valid when external clock input of reload timer 0 is set to disabled.
22	TIN1	D	External trigger input terminal of reload timer 1. Since this input is used as required while the trigger input is enabled, the port output must remain off unless intentionally used.
	P04		General purpose input/output port. This function becomes valid when external clock input of reload timer 1 is set to disabled.
23	TIN2	D	External trigger input terminal of reload timer 2. Since this input is used as required while the trigger input is enabled, the port output must remain off unless intentionally used.
	P05		General purpose input/output port. This function becomes valid when external clock input of reload timer 2 is set to disabled.

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Pin no.	Pin name	Circuit type	Description
24	TOT1	D	Output terminal of reload timer 1. This function becomes valid when output of reload timer 1 is set to enabled.
	P06		General purpose input/output port. This function becomes valid when output of reload timer 1 is set to disabled.
25	TOT2	D	Output terminal of reload timer 2. This function becomes valid when output of reload timer 2 is set to enabled.
	P07		General purpose input/output port. This function becomes valid when output of reload timer 2 is set to disabled.
26	SOT0	D	UART0 data output terminal. This function becomes valid when data output of UART0 is set to enabled.
	P10		General purpose input/output port. This function becomes valid when data output of UART0 is set to disabled.
27	SIN0	D	UART0 data input terminal. Since this input is used as required while the UART0 input is enabled, the port output must remain off unless intentionally used.
	P11		General purpose input/output port. This function becomes valid when data input of UART0 is set to disabled.
28	SCK0	D	UART0 clock input/output terminal. This function becomes valid when clock output of UART0 is set to enabled.
	P12		General purpose input/output port. This function becomes valid when clock output of UART0 is set to disabled.
29	SOT1	D	UART1 data output terminal. This function becomes valid when data output of UART1 is set to enabled.
	P13		General purpose input/output port. This function becomes valid when data output of UART1 is set to disabled.
30	SIN1	D	UART1 data input terminal. Since this input is used as required while the UART1 input is enabled, the port output must remain off unless intentionally used.
	P14		General purpose input/output port. This function becomes valid when data input of UART1 is set to disabled.
31	SCK1	D	UART1 clock input/output terminal. This function becomes valid when clock output of UART1 is set to enabled.
	P15		General purpose input/output port. This function becomes valid when clock output of UART1 is set to disabled.
32	INT6	E	External interrupt input terminal. Since this input is used as required while the corresponding external interrupt is enabled, the port output must remain off unless intentionally used.
	PPG5		Output terminal of PPG timer 5. This function becomes valid when output of PPG timer 5 is set to enabled.
	P16		General purpose input/output port. This function becomes valid when output of PPG timer 5 is set to disabled.

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Pin no.	Pin name	Circuit type	Description
33	PPG6	D	Output terminal of PPG timer 6. This function becomes valid when output of PPG timer 6 is set to enabled.
	P17		General purpose input/output port. This function becomes valid when output of PPG timer 6 is set to disabled.
34	ADTG1	D	External trigger input terminal of A/D converter 1. Since this input is used as required while it selects as A/D activation trigger cause, the port output must remain off unless intentionally used.
	IC2		Trigger input terminal of input capture 2. The port can serve as an input when set for input with the setting of the input capture trigger input. When the port is used for input capture input, this input is used as required. The port output must therefore remain off unless intentionally used.
	P20		General purpose input/output port. This function becomes valid when the setting of the external trigger input of A/D converter 1 or the setting of the input capture trigger input is set to disabled.
35	ADTG2	D	External trigger input terminal of A/D converter 2. Since this input is used as required while it selects as A/D activation trigger cause, the port output must remain off unless intentionally used.
	IC3		Trigger input terminal of input capture 3. The port can serve as an input when set for input with the setting of the input capture trigger input. When the port is used for input capture input, this input is used as required. The port output must therefore remain off unless intentionally used.
	P21		General purpose input/output port. This function becomes valid when the setting of the external trigger input of A/D converter 2 or the setting of the input capture trigger input is set to disabled.
36	PW10	D	Pulse width counter input of PWC timer 0 This function becomes valid when pulse width counter input of PWC timer 0 is set to enabled.
	P22		General purpose input/output port. This function becomes valid when pulse width counter input of PWC timer 0 is set to disabled.
37	DTTI	D	Control input signal of multi-function timer waveform generator output RTO0 to RTO5. This function becomes valid when DTTI input is set to enabled.
	P23		General purpose input/output port. This function becomes valid when input of DTTI is set to disabled.
38	CKI	D	External clock input terminal of free-run timer. Since this input is used as required while the port is used for external clock input terminal of free-run timer, the port output must remain off unless intentionally used.
	P24		General purpose input/output port. This function becomes valid when external clock input of free-run timer is set to disabled.

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Pin no.	Pin name	Circuit type	Description
39	IC0	D	Trigger input terminal of input capture 0. The port can serve as an input when set for input with the setting of the trigger input of input capture 0. When the port is used for input capture input, this input is used as required. The port output must therefore remain off unless intentionally used.
	P25		General purpose input/output port. This function becomes valid when trigger input of input capture 0 is set to disabled.
40	IC1	D	Trigger input terminal of input capture 1. The port can serve as an input when set for input with the setting of the trigger input of input capture 1. When the port is used for input capture input, this input is used as required. The port output must therefore remain off unless intentionally used.
	P26		General purpose input/output port. This function becomes valid when trigger input of input capture 1 is set to disabled.
41	P27	D	General purpose input/output port.
42	PPG0	D	Output terminal of PPG timer 0. This function becomes valid when output of PPG timer 0 is set to enabled.
	PG1		General purpose input/output port. This function becomes valid when output of PPG timer 0 is set to disabled.
43	MD2	H, K	Mode terminal 2. Setting these pins determines the basic operation mode. Connect to V_{CC} or V_{SS} . The circuit type of flash models is K.
44	MD1	H, K	Mode terminal 1. Setting these pins determines the basic operation mode. Connect to V_{CC} or V_{SS} . The circuit type of flash models is K.
45	MD0	H	Mode terminal 0. Setting these pins determines the basic operation mode. Connect to V_{CC} or V_{SS} .
46	X0	A	Clock (oscillation) output terminal.
47	X1	A	Clock (oscillation) input terminal.
49	PPG4	D	Output terminal of PPG timer 4. This function becomes valid when output of PPG timer 4 is set to enabled.
	P37		General purpose input/output port. This function becomes valid when output of PPG timer 4 is set to disabled.
50	INT7	E	External interrupt input terminal. Since this input is used as required while the corresponding external interrupt is enabled, the port output must remain off unless intentionally used.
	PPG7		Output terminal of PPG timer 7. This function becomes valid when output of PPG timer 7 is set to enabled.
	P36		General purpose input/output port. This function becomes valid when output of PPG timer 7 is set to disabled.
51	INIT	I	External reset input terminal.

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Pin no.	Pin name	Circuit type	Description
52	RTO5	J	Waveform generator output terminal of multi-function timer. This terminal outputs waveform set at the waveform generator. This function becomes valid when waveform generator output of multi-function timer is set to enabled.
	P35		General purpose input/output port. This function becomes valid when output of waveform generator is set to disabled.
53	RTO4	J	Waveform generator output terminal of multi-function timer. This terminal outputs waveform set at the waveform generator. This function becomes valid when waveform generator output of multi-function timer is set to enabled.
	P34		General purpose input/output port. This function becomes valid when output of waveform generator is set to disabled.
54	RTO3	J	Waveform generator output terminal of multi-function timer. This terminal outputs waveform set at the waveform generator. This function becomes valid when waveform generator output of multi-function timer is set to enabled.
	P33		General purpose input/output port. This function becomes valid when output of waveform generator is set to disabled.
55	RTO2	J	Waveform generator output terminal of multi-function timer. This terminal outputs waveform set at the waveform generator. This function becomes valid when waveform generator output of multi-function timer is set to enabled.
	P32		General purpose input/output port. This function becomes valid when output of waveform generator is set to disabled.
56	RTO1	J	Waveform generator output terminal of multi-function timer. This terminal outputs waveform set at the waveform generator. This function becomes valid when waveform generator output of multi-function timer is set to enabled.
	P31		General purpose input/output port. This function becomes valid when output of waveform generator is set to disabled.
57	RTO0	J	Waveform generator output terminal of multi-function timer. This terminal outputs waveform set at the waveform generator. This function becomes valid when waveform generator output of multi-function timer is set to enabled.
	P30		General purpose input/output port. This function becomes valid when output of waveform generator is set to disabled.
58	INT0	E	External interrupt input terminal. Since this input is used as required while the corresponding external interrupt is enabled, the port output must remain off unless intentionally used.
	P40		General purpose input/output port. This function becomes valid when external interrupt input is set to disabled.
59	INT1	E	External interrupt input terminal. Since this input is used as required while the corresponding external interrupt is enabled, the port output must remain off unless intentionally used.
	P41		General purpose input/output port. This function becomes valid when external interrupt input is set to disabled.
60	INT2	E	External interrupt input terminal. Since this input is used as required while the corresponding external interrupt is enabled, the port output must remain off unless intentionally used.
	P42		General purpose input/output port. This function becomes valid when external interrupt input is set to disabled.

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Pin no.	Pin name	Circuit type	Description
61	INT3	E	External interrupt input terminal. Since this input is used as required while the corresponding external interrupt is enabled, the port output must remain off unless intentionally used.
	P43		General purpose input/output port. This function becomes valid when external interrupt input is set to disabled.

• Power supply and GND pins

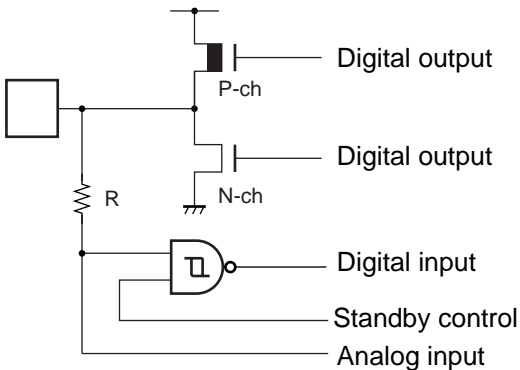
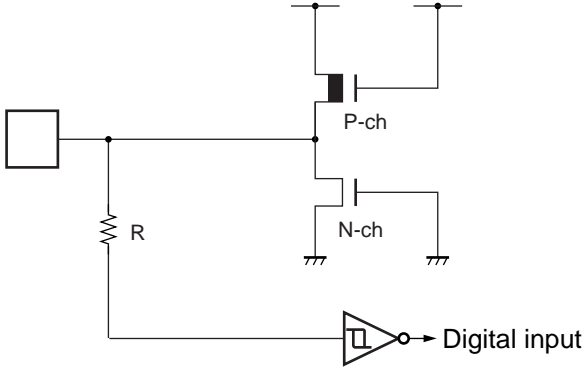
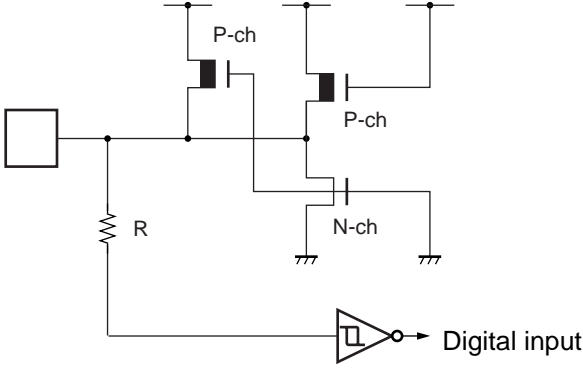
Pin no.	Pin name	Description
16, 48	Vss	GND pins. Apply equal potential to all of the pins.
17	Vcc	Power supply pin. Apply equal potential to all of the pins.
64	AVcc	Analog power supply pin for A/D converter.
63	AVRH2	Analog reference power supply pin for A/D converter 2.
62	AVRH1	Analog reference power supply pin for A/D converter 1.
1	AVss	Analog GND pin for A/D converter.
15	C	Condenser connection pin for internal regulator.
2	ACC	Condenser connection pin for analog.

■ I/O CIRCUIT TYPE

Type	Circuit type	Remarks
A		<ul style="list-style-type: none"> • Oscillation feedback resistance for high speed (main clock oscillation) : approx. 1 MΩ
D		<ul style="list-style-type: none"> • CMOS level output • CMOS level hysteresis input • With standby control • With Pull-up control • Pull-up resistance value = approx. 50 kΩ (Typ) • $I_{OL} = 4 \text{ mA}$
E		<ul style="list-style-type: none"> • CMOS level output • CMOS level hysteresis input • Without standby control • With Pull-up control • Pull-up resistance value = approx. 50 kΩ (Typ) • $I_{OL} = 4 \text{ mA}$

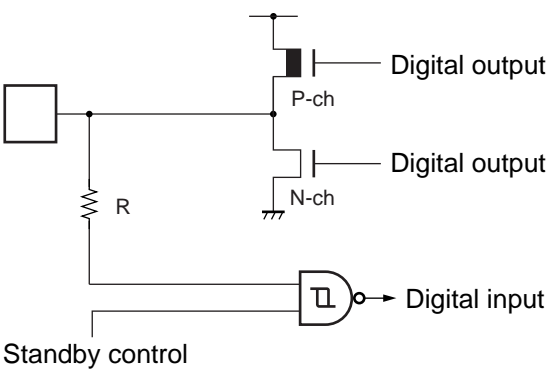
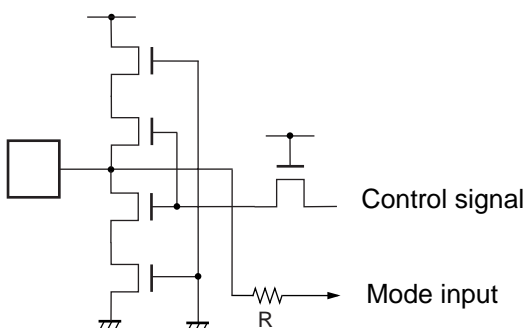
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Type	Circuit type	Remarks
G		<ul style="list-style-type: none">• Analog/CMOS level hysteresis input/output pin• CMOS level output• CMOS level hysteresis input (attached with standby control)• Analog input (Analog input is enabled when AICR's corresponding bit is set to "1".)• $I_{OL} = 4 \text{ mA}$
H		<ul style="list-style-type: none">• CMOS level hysteresis input• Without standby control
I		<ul style="list-style-type: none">• CMOS level hysteresis input• With pull-up resistor• Pull-up resistance value = approx. 50 kΩ (Typ)• Without standby control

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Type	Circuit type	Remarks
J	 <p>The diagram for Type J shows a square box connected to a resistor R. The other end of R is connected to a node that branches to a P-channel MOSFET (labeled 'P-ch') and an AND gate. The P-channel MOSFET's source is connected to VDD and its gate is connected to the same node as the AND gate. The drain of the P-channel MOSFET is connected to a 'Digital output'. The N-channel MOSFET's source is connected to ground and its gate is connected to the same node as the AND gate. The drain of the N-channel MOSFET is connected to another 'Digital output'. The AND gate has two inputs: one from the node after resistor R and another from a 'Standby control' signal. The output of the AND gate is labeled 'Digital input'.</p>	<ul style="list-style-type: none">• CMOS level output• CMOS level hysteresis input• With standby control• $I_{OL} = 12\text{ mA}$
K	 <p>The diagram for Type K shows a square box connected to a node that branches to a P-channel MOSFET and an N-channel MOSFET. The P-channel MOSFET's source is connected to VDD and its gate is connected to the node after the box. The drain of the P-channel MOSFET is connected to a 'Control signal'. The N-channel MOSFET's source is connected to ground and its gate is connected to the node after the box. The drain of the N-channel MOSFET is connected to a 'Mode input' through a resistor R.</p>	<p>FLASH product only</p> <ul style="list-style-type: none">• CMOS level input• High voltage control for test of FLASH

MB91265 Series

■ HANDLING DEVICES

- Preventing Latchup

Latch-up may occur in a CMOS IC if a voltage greater than V_{CC} or less than V_{SS} is applied to an input or output pin or if an above-rating voltage is applied between V_{CC} pin and V_{SS} pin. A latchup, if it occurs, significantly increases the power supply current and may cause thermal destruction of an element. When you use a CMOS IC, don't exceed the absolute maximum rating.

- Treatment of Unused Input Pins

Do not leave an unused input pin open, since it may cause a malfunction. Handle by, for example, using a pull-up or pull-down resistor.

- About power supply pins

In products with multiple V_{CC} and V_{SS} pins, the pins of the same potential are internally connected in the device to avoid abnormal operations including latch-up. However, you must connect the pins to external power supply and a ground line to lower the electro-magnetic emission level, to prevent abnormal operation of strobe signals caused by the rise in the ground level, and to conform to the total output current rating.

Moreover, connect the current supply source with the V_{CC} and V_{SS} pins of this device at the low impedance.

It is also advisable to connect a ceramic bypass capacitor of approximately 0.1 μF between V_{CC} and V_{SS} near this device.

- About Crystal oscillator circuit

Noise near the X0 and X1 pins may cause the device to malfunction. Design the printed circuit board so that X0, X1, the crystal oscillator (or ceramic oscillator), and the bypass capacitor to ground are located as close to the device as possible.

It is strongly recommended to design the PC board artwork with the X0 and X1 pins surrounded by ground plane because stable operation can be expected with such a layout.

- Mode pins (MD0 to MD2)

These pins should be connected directly to V_{CC} pin or V_{SS} pin.

To prevent the device erroneously switching to test mode due to noise, design the printed circuit board such that the distance between the mode pins and V_{CC} or V_{SS} is as short as possible and the connection impedance is low.

- Operation at start-up

Be sure to execute setting initialized reset (INIT) with $\overline{\text{INIT}}$ pin immediately after start-up.

Also, in order to provide a delay while the oscillator circuit stabilize immediately after start-up, maintain the "L" level input to the $\overline{\text{INIT}}$ pin for the required stabilization wait time of the oscillation circuit.

(For INIT via the $\overline{\text{INIT}}$ pin, the oscillation stabilization wait time setting is initialized to the minimum value.)

- Order of power turning ON/OFF

Use the following procedure for turning the power on or off.

Note that, even if the A/D converter is not used, keep the following pins connected with the level as described below.

$AV_{CC} = V_{CC}$ level

$AV_{SS} = V_{SS}$ level

- When Powering ON : $V_{CC} \rightarrow AV_{CC} \rightarrow AVRH$
- When Powering OFF : $AVRH \rightarrow AV_{CC} \rightarrow V_{CC}$

- About oscillation input at power on

When turning the power on, maintain clock input until the device is released from the oscillation stabilization wait state.

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- Caution for operation during PLL clock mode

Even if the oscillator comes off or the clock input stops with the PLL clock selected for this device, the device may continue to operate at the free-run frequency of the PLL's internal self-oscillating oscillator circuit.

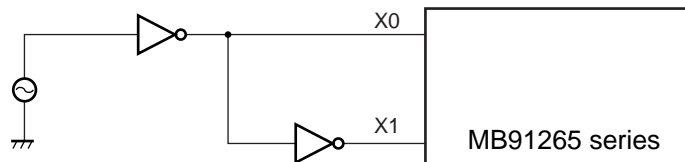
Performance of this operation, however, cannot be guaranteed.

- External clock

When external clock is selected, the opposite phase clock to X0 pin must be supplied to X1 pin simultaneously.

If the STOP mode (oscillation stop mode) is used simultaneously, the X1 pin is stopped with the "H" output. So, when STOP mode is specified, approximately 1 k Ω of resistance should be added externally to avoid the collision of output.

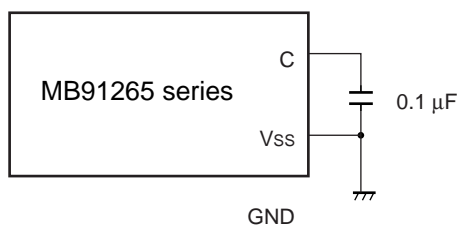
The following figure shows using an external clock.



Using an external clock

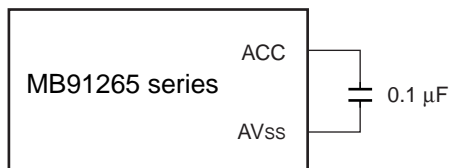
- C pin

A bypass capacitor of approximately 0.1 μ F should be connected the C pin for built-in regulator.



- ACC pin

A capacitor of approximately 0.1 μ F should be inserted between the ACC pin and the AVss pin as this product has built-in A/D converter.



- Clock control block

Take the oscillation stabilization wait time during “L” level input to the $\overline{\text{INIT}}$ pin.

- Switch shared port function

To switch between the use as a port and the use as a dedicated pin, use the port function register (PFR).

- Low-power Consumption Mode

(1) To enter the standby mode, use the synchronous standby mode (set with the SYNCS bit as bit 8 in the TBCR: or time-base counter control register) and be sure to use the following sequence

(LDI	#value_of_standby, R0)	: value_of standby is write data to STCR.
(LDI	#_STCR, R12)	: _STCR is address (481 _H) of STCR.
STB	R0, @R12	: Writing to standby control register (STCR)
LDUB	@R12, R0	: STCR read for synchronous standby
LDUB	@R12, R0	: Dummy re-read of STCR
NOP		: NOP × 5 for arrangement of timing
NOP		
NOP		
NOP		
NOP		

In addition, please set I flag, ILM, and ICR to diverge to the interruption handler that is the return factor after the standby returns.

(2) Please do not do the following when the monitor debugger is used.

- Break point setting for above instruction lines
- Step execution for above instruction lines

- Notes on the PS register

As the PS register is processed by some instructions in advance, exception handling below may cause the interrupt handling routine to break when the debugger is used or the display contents of flags in the PS register to be updated.

As the microcontroller is designed to carry out reprocessing correctly upon returning from such an EIT event, it performs operations before and after the EIT as specified in either case.

1. The following operations are performed when the instruction followed by a DIV0U/DIV0S instruction results in: (a) acceptance of a user interrupt or NMI, (b) step execution, or (c) a break at a data event or emulator menu.

- (1) The D0 and D1 flags are updated in advance.
- (2) An EIT handling routine (user interrupt, NMI, or emulator) is executed.
- (3) Upon returning from the EIT, the DIV0U/DIV0S instruction is executed and the D0 and D1 flags are updated to the same values as in (1).

2. The following operations are performed when the ORCCR/STILM/MOV Ri and PS instructions are executed to enable interruptions when a user interrupt or NMI trigger even has occurred.

- (1) The PS register is updated in advance.
- (2) An EIT handling routine (user interrupt, NMI) is executed.
- (3) Upon returning from the EIT, the above instructions are executed and the PS register is updated to the same value as in (1).

MB91265 Series

- Watchdog timer

The watchdog timer built in this model monitors a program that it defers a reset within a certain period of time. The watchdog timer resets the CPU if the program runs out of controls, preventing the reset defer function from being executed. Once the function of the watchdog timer is enabled, therefore, the watchdog timer keeps on operating programs until it resets the CPU.

As an exception, the watchdog timer defers a reset timing automatically under the condition in which the CPU stops program execution.

■ NOTE ON DEBUGGER

- Step execution of RETI command

If an interrupt occurs frequently during step execution, the corresponding interrupt handling routine is executed repeatedly after step execution.

This will prevent the main routine and low-interrupt-level programs from being executed.

Do not execute step of RETI instruction for escape.

Disable the corresponding interrupt and execute debugger when the corresponding interrupt handling routine no longer needs debugging.

- Operand break

Do not apply a data event break to access to the area containing the address of a system stack pointer.

- Execution in an unused area of FLASH memory

Accidentally executing an instruction in an unused area of FLASH memory (with data placed at 0xFFFF) prevents breaks from being accepted.

To prevent this, the code event address mask function of the debugger should be used to cause a break when accessing an instruction in an unused area.

- Power-on debugging

All of the following three conditions must be satisfied when the power supply is turned off by power-on debugging.

(1) The time for the user power to fall from 0.9 V_{CC} to 0.5 V_{CC} is 25 μ s or longer.

Note : In a dual-power system, V_{CC} indicates the external I/O power supply voltage.

(2) CPU operating frequency must be higher than 1 MHz.

(3) During execution of user program

- Interrupt handler for NMI request (tool)

Add the following program to the interrupt handler to prevent the device from malfunctioning in case the factor flag to be set only in response to a break request from the ICE is set, for example, by an adverse effect of noise to the DSU pin while the ICE is not connected. Enable to use the ICE while adding this program.

Additional location

Next interrupt handler

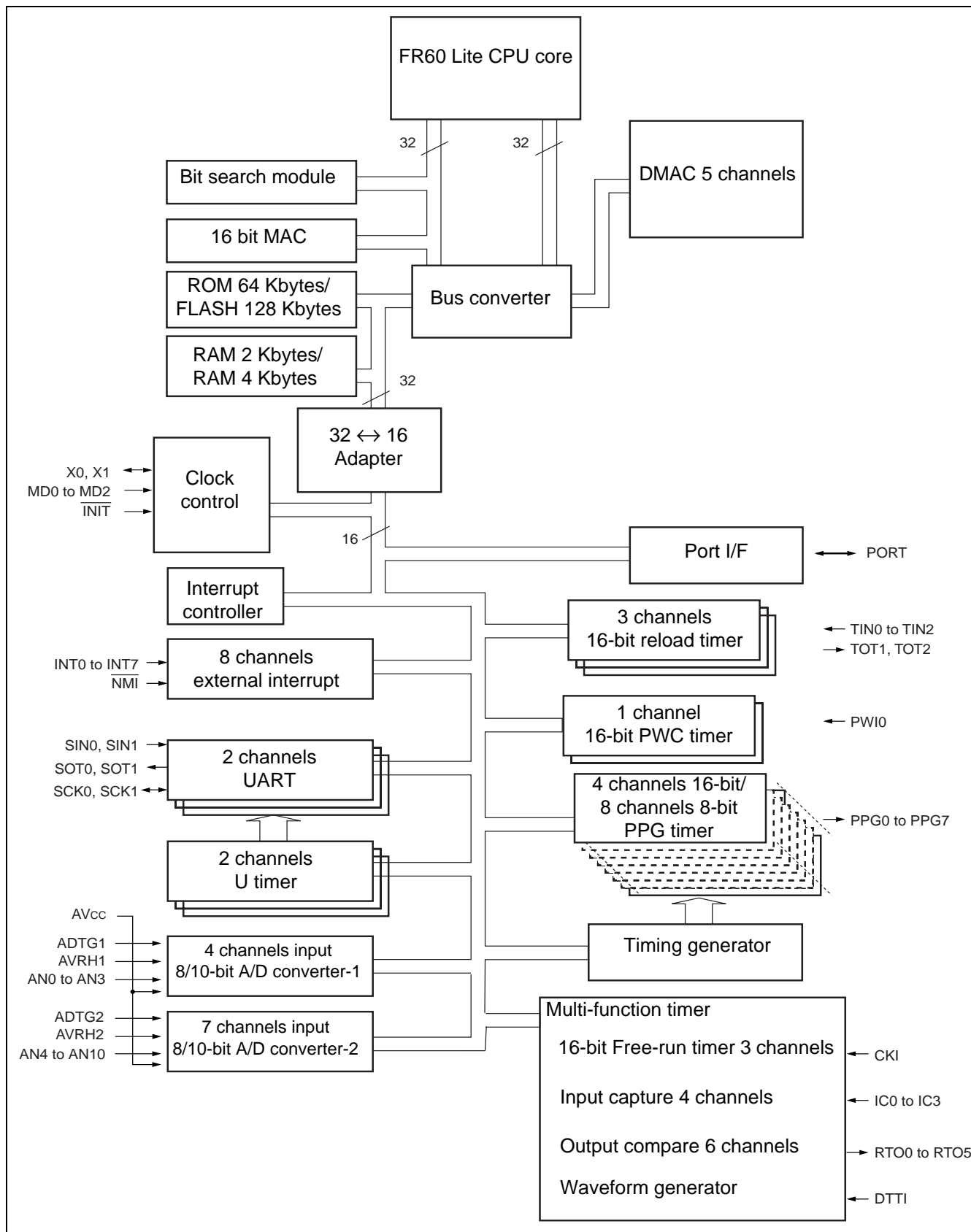
Interrupt source	: NMI request (tool)
Interrupt number	: #13 (decimal) , 0D (hexadecimal)
Offset	: 3C8 _H
Address TBR is default	: 000FFFC8 _H

Additional program

```
STM    (R0, R1)
LDI     #B00H, R0;    : B00H is the address of DSU break factor register.
LDI     #0, R1
STB     R1, @R0        : Clear the break factor register.
LDM     (R0, R1)
RETI
```

MB91265 Series

■ BLOCK DIAGRAM



■ MEMORY SPACE

1. Memory space

The FR family has 4 Gbytes of logical address space (2^{32} addresses) available to the CPU by linear access.

- Direct Addressing Areas

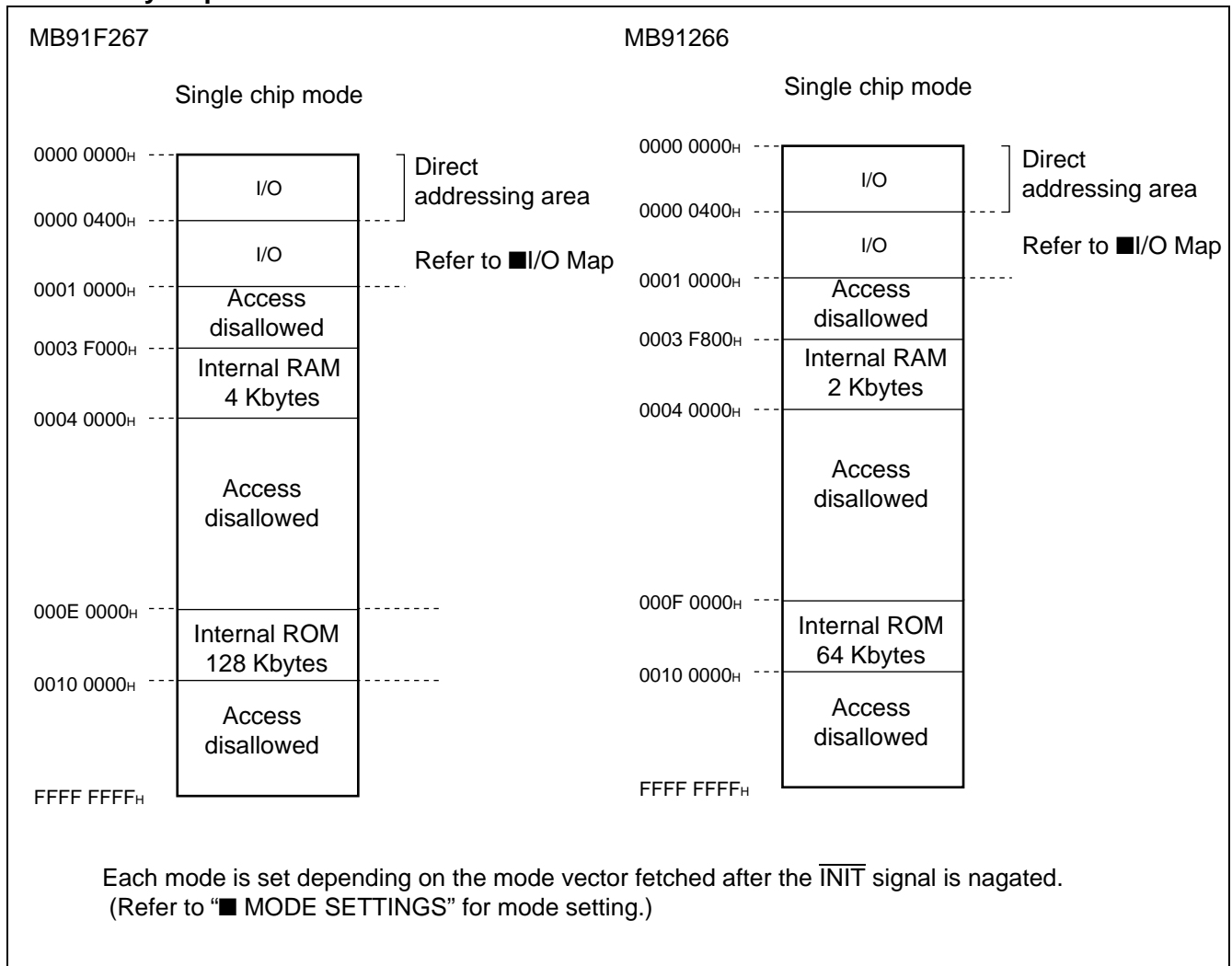
The following address space areas are used as I/O areas.

These areas are called direct addressing areas, in which the address of an operand can be specified directly during an instruction.

The size of directly addressable areas depends on the data size to be being accessed as follows.

- byte data access : 000H-0FFH
- half word data access : 000H-1FFH
- word data access : 000H-3FFH

2. Memory Map



MB91265 Series

■ MODE SETTINGS

The FR family uses mode pins (MD2 to MD0) and a mode data to set the operation mode.

1. Mode Pins

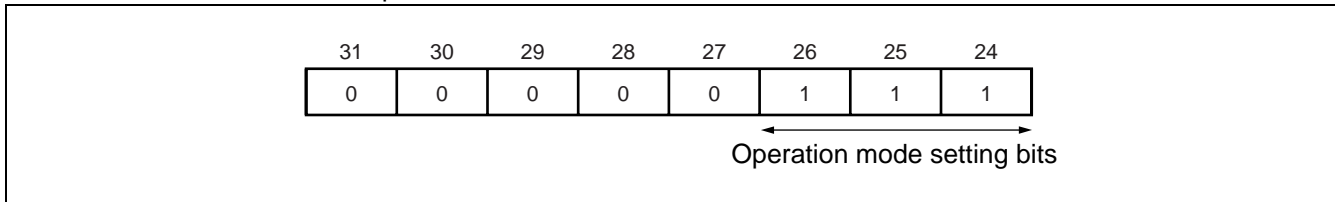
The MD2, MD1, and MD0 pins specify how the mode vector fetch and reset vector fetch is performed. Setting is prohibited other than that shown in the following table.

Mode Pins			Mode name	Reset vector access area	Remarks
MD2	MD1	MD0			
0	0	0	Internal ROM mode vector	Internal	
0	0	1	External ROM mode vector	External	Prohibit

2. Mode data

Data written to the internal mode register (MODR) by a mode vector fetch is called mode data. After an operation mode has been set in the mode register, the device operates in the operation mode. The mode data is set by all reset sources. User programs cannot set data to the mode register.

<Details of mode data description>



[bit31 to 24] Reserved bit
Be sure to set this bit to “00000111_B”.
Operation is not guaranteed when any value other than “00000111_B” is set.

3. Note

Mode data set in the mode vector must be placed as byte data at 0x000FFFF8. Use the highest byte from bit 31 to bit 24 for placement as the FR family uses the big endian method for byte endian.

	31	24	23	16	15	8	7	0
Incorrect	0x000FFFF8	XXXXXXXX	XXXXXXXX	XXXXXXXX	Mode Data			
Correct	0x000FFFF8	Mode Data	XXXXXXXX	XXXXXXXX	XXXXXXXX			
	0x000FFFC	Reset Vector						

■ I/O MAP

This shows the location of the various peripheral resource registers in the memory space.

[How to read the table]

Address	Register				Block
	+ 0	+ 1	+ 2	+ 3	
000000 _H	PDR0 [R/W]B XXXXXXXX	PDR1 [R/W]B XXXXXXXX	PDR2 [R/W]B XXXXXXXX	PDR3 [R/W]B XXXXXXXX	Port data register

Read/write attribute, Access unit
(B : byte, H : half word, W : word)

Initial value after a reset

Register name (First-column register at address 4n; second-column register at address 4n + 2)

Location of left-most register (When using word access, the register in column 1 is in the MSB side of the data.)

Note : Initial values of register bits are represented as follows :

- " 1 " : Initial Value : " 1 "
- " 0 " : Initial Value : " 0 "
- " X " : Initial Value : " undefined "
- " - " : No physical register at this location

MB91265 Series

Ad- dress	Register				Block
	+ 0	+ 1	+ 2	+ 3	
000000 _H	PDR0 [R/W] B, H, W XXXXXXXX	PDR1 [R/W] B, H, W XXXXXXXX	PDR2 [R/W] B, H, W XXXXXXXX	PDR3 [R/W] B, H, W XXXXXXXX	Port data register
000004 _H	PDR4 [R/W] B, H, W -XXXXXXXX	PDR5 [R/W] B, H, W XXXXXXXX	—	—	
000008 _H	—	—	—	—	
00000C _H	—	—	—	—	
000010 _H	PDRG [R/W] B, H, W -----X-	—	—	—	
000014 _H to 00003C _H	—				Reserved
000040 _H	EIRR0 [R/W] B, H, W 00000000	ENIR0 [R/W] B, H, W 00000000	ELVR0 [R/W] B, H, W 00000000 00000000		External interrupt (INT0 to INT7)
000044 _H	DICR [R/W] B, H, W -----0	HRCL [R/W, R] B, H, W 0--11111	—	—	Delay interrupt/ Hold request
000048 _H	TMRLR0 [W] H, W XXXXXXXX XXXXXXXX		TMR0 [R] H, W XXXXXXXX XXXXXXXX		Reload timer 0
00004C _H	—		TMCSR0 [R/W, R] B, H, W ---00000 00000000		
000050 _H	TMRLR1 [W] H, W XXXXXXXX XXXXXXXX		TMR1 [R] H, W XXXXXXXX XXXXXXXX		Reload timer 1
000054 _H	—		TMCSR1 [R/W, R] B, H, W ---00000 00000000		
000058 _H	TMRLR2 [W] H, W XXXXXXXX XXXXXXXX		TMR2 [R] H, W XXXXXXXX XXXXXXXX		Reload timer 2
00005C _H	—		TMCSR2 [R/W, R] B, H, W ---00000 00000000		
000060 _H	SSR0 [R/W, R] B, H, W 00001000	SIDR0 [R]/SODR0[W] B, H, W XXXXXXXX	SCR0 [R/W] B, H, W 00000100	SMR0 [R/W, W] B, H, W 00--0-0-	UART0
000064 _H	UTIM0 [R] H / UTIMR0 [W] H 00000000 00000000		DRCL0 [W] B -----	UTIMC0 [R/W] B 0--00001	U-timer 0
000068 _H	SSR1 [R/W, R] B, H, W 00001000	SIDR1 [R]/SODR1[W] B, H, W XXXXXXXX	SCR1 [R/W] B, H, W 00000100	SMR1 [R/W] B, H, W 00--0-0-	UART1
00006C _H	UTIM1 [R] H / UTIMR1 [W] H 00000000 00000000		DRCL1 [W] B -----	UTIMC1 [R/W] B 0--00001	U-timer 1
000070 _H	—	—	—	—	
000074 _H	—	—	—	—	
000078 _H	—	—	—	—	
00007C _H	—	—	—	—	

(Continued)

Ad- dress	Register				Block
	+ 0	+ 1	+ 2	+ 3	
000080 _H	ADCH1 [R/W] B, H, W XXXX0XX0	ADMD1 [R/W] B, H, W 00001111	ADCD11 [R] B, H, W XXXXXXXXXX	ADCD10 [R] B, H, W XXXXXXXXXX	A/D converter 1/ AICR1
000084 _H	ADCS1 [R/W, W] B, H, W 00000X00	—	AICR1 [R/W] B, H, W ----0000	—	
000088 _H	ADCH2 [R/W] B, H, W XXXX0XX0	ADMD2 [R/W] B, H, W 00001111	ADCD21 [R] B, H, W XXXXXXXXXX	ADCD20 [R] B, H, W XXXXXXXXXX	A/D converter 2/ AICR2
00008C _H	ADCS2 [R/W, W] B, H, W 00000X00	—	AICR2 [R/W] B, H, W -0000000	—	
000090 _H	OCCPBH0, OCCPBL0[W] / OCCPH0, OCCPL0[R] H, W 00000000 00000000		OCCPBH1, OCCPBL1[W] / OCCPH1, OCCPL1 [R] H, W 00000000 00000000		16-bit OCU
000094 _H	OCCPBH2, OCCPBL2[W] / OCCPH2, OCCPL2 [R] H, W 00000000 00000000		OCCPBH3, OCCPBL3[W] / OCCPH3, OCCPL3 [R] H, W 00000000 00000000		
000098 _H	OCCPBH4, OCCPBL4[W] / OCCPH4, OCCPL4 [R] H, W 00000000 00000000		OCCPBH5, OCCPBL5[W] / OCCPH5, OCCPL5 [R] H, W 00000000 00000000		
00009C _H	OCSH1 [R/W] B, H, W X1100000	OCSL0 [R/W] B, H, W 00001100	OCSH3 [R/W] B, H, W X1100000	OCSL2 [R/W] B, H, W 00001100	
0000A0 _H	OCSH5 [R/W] B, H, W X1100000	OCSL4 [R/W] B, H, W 00001100	OCMOD [R/W] B, H, W XX000000	—	
0000A4 _H	CPCLRBH0, CPCLRBL0[W]/ CPCLRH0, CPCLRL0[R] H, W 11111111 11111111		TCDTH0, TCDTL0 [R/W] H, W 00000000 00000000		16-bit free-run timer 0
0000A8 _H	TCCSH0 [R/W] B, H, W 00000000	TCCSL0 [R/W] B, H, W 01000000	—	ADTRGC [R/W] B, H, W XXXX0000	
0000AC _H	IPCPH0, IPCPL0 [R] H, W XXXXXXXXXX XXXXXXXXX		IPCPH1, IPCPL1 [R] H, W XXXXXXXXXX XXXXXXXXX		16-bit ICU
0000B0 _H	IPCPH2, IPCPL2 [R] H, W XXXXXXXXXX XXXXXXXXX		IPCPH3, IPCPL3 [R] H, W XXXXXXXXXX XXXXXXXXX		
0000B4 _H	PICSH01 [W] B, H, W 00000000	PICSL01 [R/W] B, H, W 00000000	ICSH23 [R] B, H, W XXXXXX00	ICSL23 [R/W]B, H, W 00000000	
0000B8 _H	—	—	—	—	
0000BC _H	TMRRH0, TMRRL0 [R/W] H, W XXXXXXXXXX XXXXXXXXX		TMRRH1, TMRRL1 [R/W] H, W XXXXXXXXXX XXXXXXXXX		Waveform generator
0000C0 _H	TMRRH2, TMRRL2 [R/W] H, W XXXXXXXXXX XXXXXXXXX		—	—	
0000C4 _H	DTCCR0 [R/W] B, H, W 00000000	DTCCR1 [R/W] B, H, W 00000000	DTCCR2 [R/W] B, H, W 00000000	—	
0000C8 _H	—	SIGCR1 [R/W] B, H, W 00000000	—	SIGCR2 [R/W] B, H, W XXXXXXXX1	

(Continued)

MB91265 Series

Ad- dress	Register				Block
	+ 0	+ 1	+ 2	+ 3	
0000CC _H	—		ADCOMP1 [R/W] H, W 00000000 00000000		A/D COMP
0000D0 _H	ADCOMP2 [R/W] H, W 00000000 00000000		ADCOMP2 [R/W] B, H, W XX000000	ADCOMP1 [R/W] B, H, W XXXXX000	
0000D4 _H	—	—	—	—	Reserved
0000D8 _H	—	—	—	—	
0000DC _H	—	—	—	—	
0000E0 _H	PWCSR0 [R/W, R] B, H, W 00000000 00000000		PWCR0 [R] H, W 00000000 00000000		16-bit PWC timer
0000E4 _H	—	—	—	—	
0000E8 _H	—	PDIVR0 [R/W] B, H, W XXXXXX000	—	—	
0000EC _H	—	—	—	—	Reserved
0000F0 _H	—	—	—	—	
000F4 _H to 000FC _H	—	—	—	—	
000100 _H	PRLH0 [R/W] B, H, W XXXXXXXXXX	PRL0 [R/W] B, H, W XXXXXXXXXX	PRLH1 [R/W] B, H, W XXXXXXXXXX	PRL1 [R/W] B, H, W XXXXXXXXXX	8/16-bit PPG timer 0 to 7
000104 _H	PRLH2 [R/W] B, H, W XXXXXXXXXX	PRL2 [R/W] B, H, W XXXXXXXXXX	PRLH3 [R/W] B, H, W XXXXXXXXXX	PRL3 [R/W] B, H, W XXXXXXXXXX	
000108 _H	PPGC0 [R/W] B, H, W 00000000	PPGC1 [R/W] B, H, W 00000000	PPGC2 [R/W] B, H, W 00000000	PPGC3 [R/W] B, H, W 00000000	
00010C _H	PRLH4 [R/W] B, H, W XXXXXXXXXX	PRL4 [R/W] B, H, W XXXXXXXXXX	PRLH5 [R/W] B, H, W XXXXXXXXXX	PRL5 [R/W] B, H, W XXXXXXXXXX	
000110 _H	PRLH6 [R/W] B, H, W XXXXXXXXXX	PRL6 [R/W] B, H, W XXXXXXXXXX	PRLH7 [R/W] B, H, W XXXXXXXXXX	PRL7 [R/W] B, H, W XXXXXXXXXX	
000114 _H	PPGC4 [R/W] B, H, W 00000000	PPGC5 [R/W] B, H, W 00000000	PPGC6 [R/W] B, H, W 00000000	PPGC7 [R/W] B, H, W 00000000	
000118 _H to 00012C _H	—	—	—	—	Reserved
000130 _H	TRG [R/W] B, H, W ----- 00000000		—	GATEC [R/W] B, H, W XXXXXX00	8/16-bit PPG timer 0 to 7
000134 _H	REVC [R/W] B, H, W ----- 00000000		—	—	
000138 _H	—	—	—	—	Reserved
00013C _H	—	—	—	—	
000140 _H	—	—	—	—	

(Continued)

MB91265 Series

Ad- dress	Register				Block
	+ 0	+ 1	+ 2	+ 3	
000144 _H	TTCR0 [R/W] B, H, W 00000000	—	—	TSTPR0 [R] B, H, W 00000000	Timing generator
000148 _H	COMP0 [R/W] B, H, W 00000000	COMP2 [R/W] B, H, W 00000000	COMP4 [R/W] B, H, W 00000000	COMP6 [R/W] B, H, W 00000000	
00014C _H	—	—	—	—	
000150 _H	—	—	—	—	
000154 _H	CPCLRBH1, CPCLRBL1 [W] / CPCLRH1, CPCLRL1 [R] H, W 11111111 11111111		TCDTH1, TCDTL1 [R/W] H, W 00000000 00000000		16-bit free-run timer 1
000158 _H	TCCSH1 [R/W] B, H, W 00000000	TCCSL1 [R/W] B, H, W 01000000	—	—	
00015C _H	CPCLRBH2, CPCLRBL2 [W] / CPCLRH2, CPCLRL2 [R] H, W 11111111 11111111		TCDTH2, TCDTL2 [R/W] H, W 00000000 00000000		16-bit free-run timer 2
000160 _H	TCCSH2 [R/W] B, H, W 00000000	TCCSL2 [R/W] B, H, W 01000000	—	—	
000164 _H	—	—	—	—	Reserved
000168 _H	—	FSR2 [R/W] B, H, W 00000000	FSR1 [R/W] B, H, W ----0000	FSR0 [R/W] B, H, W 00000000	FRT selector
00016C _H to 0001FC _H	—				Reserved
000200 _H	DMACA0 [R/W] B, H, W * 00000000 0000XXXX XXXXXXXX XXXXXXXX				DMAC
000204 _H	DMACB0 [R/W] B, H, W 00000000 00000000 XXXXXXXX XXXXXXXX				
000208 _H	DMACA1 [R/W] B, H, W* 00000000 0000XXXX XXXXXXXX XXXXXXXX				
00020C _H	DMACB1 [R/W] B, H, W 00000000 00000000 XXXXXXXX XXXXXXXX				
000210 _H	DMACA2 [R/W] B, H, W * 00000000 0000XXXX XXXXXXXX XXXXXXXX				
000214 _H	DMACB2 [R/W] B, H, W 00000000 00000000 XXXXXXXX XXXXXXXX				
000218 _H	DMACA3 [R/W] B, H, W * 00000000 0000XXXX XXXXXXXX XXXXXXXX				
00021C _H	DMACB3 [R/W] B, H, W 00000000 00000000 XXXXXXXX XXXXXXXX				
000220 _H	DMACA4 [R/W] B, H, W * 00000000 0000XXXX XXXXXXXX XXXXXXXX				
000224 _H	DMACB4 [R/W] B, H, W 00000000 00000000 XXXXXXXX XXXXXXXX				

(Continued)

MB91265 Series

Ad- dress	Register				Block
	+ 0	+ 1	+ 2	+ 3	
000228 _H to 00023C _H	—				Reserved
000240 _H	DMACR [R/W] B 0XX00000 XXXXXXXX XXXXXXXX XXXXXXXX				DMAC
000244 _H to 00024C _H	—				Reserved
000250 _H	—	—	—	—	
000254 _H to 000398 _H	—				
00039C _H	—	—	—	—	16 bit MAC
0003A0 _H	DSP-PC [R/W] XXXXXXXX	DSP-CSR [R/W, R, W] 00000000	DSP-LY [R/W] XXXXXXXX XXXXXXXX		
0003A4 _H	DSP-OT0 [R] XXXXXXXX XXXXXXXX		DSP-OT1 [R] XXXXXXXX XXXXXXXX		
0003A8 _H	DSP-OT2 [R] XXXXXXXX XXXXXXXX		DSP-OT3 [R] XXXXXXXX XXXXXXXX		
0003AC _H	—	—	—	—	
0003B0 _H	DSP-OT4 [R] XXXXXXXX XXXXXXXX		DSP-OT5 [R] XXXXXXXX XXXXXXXX		
0003B4 _H	DSP-OT6[R] XXXXXXXX XXXXXXXX		DSP-OT7 [R] XXXXXXXX XXXXXXXX		
0003B8 _H	—	—	—	—	
0003BC _H to 0003EC _H	—				Reserved
0003F0 _H	BSD0 [W] W XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX				Bit search module
0003F4 _H	BSD1 [R/W] W XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX				
0003F8 _H	BSDC [W] W XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX				
0003FC _H	BSRR [R] XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX				
000400 _H	DDR0 [R/W] B, H, W 00000000	DDR1 [R/W] B, H, W 00000000	DDR2 [R/W] B, H, W 00000000	DDR3 [R/W] B, H, W 00000000	Data direction register
000404 _H	DDR4 [R/W] B, H, W -0000000	DDR5 [R/W] B, H, W 00000000	—	—	
000408 _H	—	—	—	—	
00040C _H	—	—	—	—	
000410 _H	DDRG [R/W] B, H, W -----0-	—	—	—	

(Continued)

MB91265 Series

Address	Register				Block
	+ 0	+ 1	+ 2	+ 3	
000414 _H to 00041C _H	—				Reserved
000420 _H	PFR0 [R/W] B, H, W 00-----	PFR1 [R/W] B, H, W 0-0-00-0	—	—	Port function register
000424 _H	—	—	—	—	
000428 _H	—	—	—	—	
00042C _H	—	—	—	—	
000430 _H	—	—	—	PTFR0 [R/W] B, H, W 00000000	
000434 _H to 00043C _H	—				Reserved
000440 _H	ICR00 [R/W, R] B, H, W ----1111	ICR01 [R/W, R] B, H, W ----1111	ICR02 [R/W, R] B, H, W ----1111	ICR03 [R/W, R] B, H, W ----1111	Interrupt control unit
000444 _H	ICR04 [R/W, R] B, H, W ----1111	ICR05 [R/W, R] B, H, W ----1111	ICR06 [R/W, R] B, H, W ----1111	ICR07 [R/W, R] B, H, W ----1111	
000448 _H	ICR08 [R/W, R] B, H, W ----1111	ICR09 [R/W, R] B, H, W ----1111	ICR10 [R/W, R] B, H, W ----1111	ICR11 [R/W, R] B, H, W ----1111	
00044C _H	ICR12 [R/W, R] B, H, W ----1111	ICR13 [R/W, R] B, H, W ----1111	ICR14 [R/W, R] B, H, W ----1111	ICR15 [R/W, R] B, H, W ----1111	
000450 _H	ICR16 [R/W, R] B, H, W ----1111	ICR17 [R/W, R] B, H, W ----1111	ICR18 [R/W, R] B, H, W ----1111	ICR19 [R/W, R] B, H, W ----1111	
000454 _H	ICR20 [R/W, R] B, H, W ----1111	ICR21 [R/W, R] B, H, W ----1111	ICR22 [R/W, R] B, H, W ----1111	ICR23 [R/W, R] B, H, W ----1111	
000458 _H	ICR24 [R/W, R] B, H, W ----1111	ICR25 [R/W, R] B, H, W ----1111	ICR26 [R/W, R] B, H, W ----1111	ICR27 [R/W, R] B, H, W ----1111	
00045C _H	ICR28 [R/W, R] B, H, W ----1111	ICR29 [R/W, R] B, H, W ----1111	ICR30 [R/W, R] B, H, W ----1111	ICR31 [R/W, R] B, H, W ----1111	
000460 _H	ICR32 [R/W, R] B, H, W ----1111	ICR33 [R/W, R] B, H, W ----1111	ICR34 [R/W, R] B, H, W ----1111	ICR35 [R/W, R] B, H, W ----1111	
000464 _H	ICR36 [R/W, R] B, H, W ----1111	ICR37 [R/W, R] B, H, W ----1111	ICR38 [R/W, R] B, H, W ----1111	ICR39 [R/W, R] B, H, W ----1111	
000468 _H	ICR40 [R/W, R] B, H, W ----1111	ICR41 [R/W, R] B, H, W ----1111	ICR42 [R/W, R] B, H, W ----1111	ICR43 [R/W, R] B, H, W ----1111	
00046C _H	ICR44 [R/W, R] B, H, W ----1111	ICR45 [R/W, R] B, H, W ----1111	ICR46 [R/W, R] B, H, W ----1111	ICR47 [R/W, R] B, H, W ----1111	
000470 _H to 00047C _H	—				Reserved

(Continued)

MB91265 Series

Ad- dress	Register				Block
	+ 0	+ 1	+ 2	+ 3	
000480 _H	RSRR [R/W] B, H, W 10000000	STCR [R/W] B, H, W 00110011	TBCR [R/W] B, H, W 00XXXX00	CTBR [W] B, H, W XXXXXXXXXX	Clock control unit
000484 _H	CLKR [R/W] B, H, W 00000000	WPR [W] B, H, W XXXXXXXXXX	DIVR0 [R/W] B, H, W 00000011	DIVR1 [R/W] B, H, W 00000000	
000488 _H	—	—	—	—	
00048C _H	—	—	—	—	
000490 _H	—	—	—	—	
000494 _H to 0005FC _H	—				Reserved
000600 _H	PCR0 [R/W] B, H, W 00000000	PCR1 [R/W] B, H, W 00000000	PCR2 [R/W] B, H, W 00000000	PCR3 [R/W] B, H, W 00-----	Pull-up Control Unit
000604 _H	PCR4 [R/W] B, H, W ----0000	—	—	—	
000608 _H	—	—	—	—	
00060C _H	—	—	—	—	
000610 _H	PCRG [R/W] B, H, W -----0-	—	—	—	
000614 _H to 00063C _H	—				Reserved
000640 _H to 000FFC _H	—				
001000 _H	DMASA0 [R/W] W XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX				DMAC
001004 _H	DMADA0 [R/W] W XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX				
001008 _H	DMASA1 [R/W] W XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX				
00100C _H	DMADA1 [R/W] W XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX				
001010 _H	DMASA2 [R/W] W XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX				
001014 _H	DMADA2 [R/W] W XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX				
001018 _H	DMASA3 [R/W] W XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX				
00101C _H	DMADA3 [R/W] W XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX				
001020 _H	DMASA4 [R/W] W XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX				
001024 _H	DMADA4 [R/W] W XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX				

(Continued)

(Continued)

Address	Register				Block
	+ 0	+ 1	+ 2	+ 3	
001028 _H to 006FFC _H	—				Reserved
007000 _H	FLCR [R/W] B 01101000	—	—	—	FLASH
007004 _H	FLWC [R/W] B 00000011	—	—	—	
007008 _H	—	—	—	—	
00700C _H	—	—	—	—	
007010 _H	—	—	—	—	
007014 _H to 00BFFC _H	—				Reserved
00C000 _H to 00C07C _H	X-RAM (coefficient RAM) [R/W] 64 × 16 bit				16 bit MAC
00C080 _H to 00C0FC _H	Y-RAM (variable RAM) [R/W] 64 × 16 bit				
00C100 _H to 00C2FC _H	I-RAM (instruction RAM) [R/W] 256 × 16 bit				
00C300 _H to 00FFFC _H	—				Reserved

*: The lower 16 bits (DTC[15: 0]) of DMACA0 to DMACA4 cannot be accessed in bytes.

Notes • The initial value of FLWC (7004_H) is “00010011_B” on EVA tool. Writing “00000011_B” on the evaluation model has no effect on its operation.

- Do not execute Read Modify Write instructions on registers having a write-only bit.
- Data is undefined in reserved or (-) area.

MB91265 Series

■ INTERRUPT VECTOR

Interrupt source	Interrupt number		Interrupt level	Offset	TBR default address
	Decimal	Hexa-decimal			
Reset	0	00	—	3FC _H	000FFFFC _H
Mode vector	1	01	—	3F8 _H	000FFFF8 _H
System reserved	2	02	—	3F4 _H	000FFFF4 _H
System reserved	3	03	—	3F0 _H	000FFFF0 _H
System reserved	4	04	—	3EC _H	000FFFE _C
System reserved	5	05	—	3E8 _H	000FFFE8 _H
System reserved	6	06	—	3E4 _H	000FFFE4 _H
Coprocessor absent trap	7	07	—	3E0 _H	000FFFE0 _H
Coprocessor error trap	8	08	—	3DC _H	000FFFD _C
INTE instruction	9	09	—	3D8 _H	000FFFD8 _H
Instruction break exception	10	0A	—	3D4 _H	000FFFD4 _H
Operand break trap	11	0B	—	3D0 _H	000FFFD0 _H
Step trace trap	12	0C	—	3CC _H	000FFFC _C
NMI request (tool)	13	0D	—	3C8 _H	000FFFC8 _H
Undefined instruction exception	14	0E	—	3C4 _H	000FFFC4 _H
NMI request	15	0F	15 (F _H) fixed	3C0 _H	000FFFC0 _H
External interrupt 0	16	10	ICR00	3BC _H	000FFFB _C
External interrupt 1	17	11	ICR01	3B8 _H	000FFFB8 _H
External interrupt 2	18	12	ICR02	3B4 _H	000FFFB4 _H
External interrupt 3	19	13	ICR03	3B0 _H	000FFFB0 _H
External interrupt 4	20	14	ICR04	3AC _H	000FFFA _C
External interrupt 5	21	15	ICR05	3A8 _H	000FFFA8 _H
External interrupt 6	22	16	ICR06	3A4 _H	000FFFA4 _H
External interrupt 7	23	17	ICR07	3A0 _H	000FFFA0 _H
Reload timer 0	24	18	ICR08	39C _H	000FFF9 _C
Reload timer 1	25	19	ICR09	398 _H	000FFF98 _H
Reload timer 2	26	1A	ICR10	394 _H	000FFF94 _H
UART0(Reception completed)	27	1B	ICR11	390 _H	000FFF90 _H
UART0 (RX completed)	28	1C	ICR12	38C _H	000FFF8 _C
DTTI	29	1D	ICR13	388 _H	000FFF88 _H
DMAC0 (end, error)	30	1E	ICR14	384 _H	000FFF84 _H
DMAC1 (end, error)	31	1F	ICR15	380 _H	000FFF80 _H
DMAC2/DMAC3/DMAC4 (end, error)	32	20	ICR16	37C _H	000FFF7 _C

(Continued)

Interrupt source	Interrupt number		Interrupt level	Offset	TBR default address
	Decimal	Hexa-decimal			
UART1(Reception completed)	33	21	ICR17	378 _H	000FFF78 _H
UART1 (RX completed)	34	22	ICR18	374 _H	000FFF74 _H
System reserved	35	23	ICR19	370 _H	000FFF70 _H
System reserved	36	24	ICR20	36C _H	000FFF6C _H
16 bit MAC	37	25	ICR21	368 _H	000FFF68 _H
PPG0/PPG1	38	26	ICR22	364 _H	000FFF64 _H
PPG2/PPG3	39	27	ICR23	360 _H	000FFF60 _H
PPG4/PPG5/PPG6/PPG7	40	28	ICR24	35C _H	000FFF5C _H
System reserved	41	29	ICR25	358 _H	000FFF58 _H
Waveform0/1/2 (underflow)	42	2A	ICR26	354 _H	000FFF54 _H
Free-run timer 1 (compare clear)	43	2B	ICR27	350 _H	000FFF50 _H
Free-run timer 1 (zero detection)	44	2C	ICR28	34C _H	000FFF4C _H
Free-run timer 2 (compare clear)	45	2D	ICR29	348 _H	000FFF48 _H
Free-run timer 2 (zero detection)	46	2E	ICR30	344 _H	000FFF44 _H
Timebase timer overflow	47	2F	ICR31	340 _H	000FFF40 _H
Free-run timer 0 (compare clear)	48	30	ICR32	33C _H	000FFF3C _H
Free-run timer 0 (zero detection)	49	31	ICR33	338 _H	000FFF38 _H
System reserved	50	32	ICR34	334 _H	000FFF34 _H
A/D1	51	33	ICR35	330 _H	000FFF30 _H
A/D2	52	34	ICR36	32C _H	000FFF2C _H
PWC0 (measurement completed)	53	35	ICR37	328 _H	000FFF28 _H
System reserved	54	36	ICR38	324 _H	000FFF24 _H
PWC0 (overflow)	55	37	ICR39	320 _H	000FFF20 _H
System reserved	56	38	ICR40	31C _H	000FFF1C _H
ICU0 (capture)	57	39	ICR41	318 _H	000FFF18 _H
ICU1 (capture)	58	3A	ICR42	314 _H	000FFF14 _H
ICU2/3 (capture)	59	3B	ICR43	310 _H	000FFF10 _H
OCU0/1 (match)	60	3C	ICR44	30C _H	000FFF0C _H
OCU2/3 (match)	61	3D	ICR45	308 _H	000FFF08 _H
OCU4/5 (match)	62	3E	ICR46	304 _H	000FFF04 _H
Delay interrupt source bit	63	3F	ICR47	300 _H	000FFF00 _H
System reserved (Used by REALOS)	64	40	—	2FC _H	000FFEFC _H
System reserved (Used by REALOS)	65	41	—	2F8 _H	000FEF8 _H

(Continued)

MB91265 Series

(Continued)

Interrupt source	Interrupt number		Interrupt level	Offset	TBR default address
	Decimal	Hexa-decimal			
System reserved	66	42	—	2F4 _H	000FFE4 _H
System reserved	67	43	—	2F0 _H	000FFE0 _H
System reserved	68	44	—	2EC _H	000FEEC _H
System reserved	69	45	—	2E8 _H	000FEE8 _H
System reserved	70	46	—	2E4 _H	000FEE4 _H
System reserved	71	47	—	2E0 _H	000FEE0 _H
System reserved	72	48	—	2DC _H	000FFEDC _H
System reserved	73	49	—	2D8 _H	000FFED8 _H
System reserved	74	4A	—	2D4 _H	000FFED4 _H
System reserved	75	4B	—	2D0 _H	000FFED0 _H
System reserved	76	4C	—	2CC _H	000FFECC _H
System reserved	77	4D	—	2C8 _H	000FFEC8 _H
System reserved	78	4E	—	2C4 _H	000FFEC4 _H
System reserved	79	4F	—	2C0 _H	000FFEC0 _H
Used by INT instruction	80 to 255	50 to FF	—	2BC _H to 000 _H	000FFEC _H to 000FFC00 _H

■ PIN STATUS IN EACH CPU STATE

Terms used as the status of pins mean as follows.

- Input enabled
Indicates that the input function can be used.
- Input 0 fixed
Indicates that the input level has been internally fixed to be 0 to prevent leakage when the input is released.
- Output Hi-Z
- Output is maintained.
Indicates the output in the output state existing immediately before this mode is established.
If the device enters this mode with an internal output peripheral operating or while serving as an output port, the output is performed by the internal peripheral or the port output is maintained, respectively.
- State existing immediately before is maintained.
When the device serves for output or input immediately before entering this mode, the device maintains the output or is ready for the input, respectively.

• List of pin status (single chip mode)

Pin no.	Pin name	Function	At initializing		At sleep mode	At Stop mode	
			$\overline{\text{INIT}} = \text{L}^{*1}$	$\overline{\text{INIT}} = \text{H}^{*2}$		Hi-Z = 0	Hi-Z = 1
3 to 10	P50 to P57	AN0 to AN7	Output Hi-Z/ Input disabled	Output Hi-Z/ Input enabled	Retention of the immedi- ately prior state	Retention of the immediately prior state	Output Hi-Z/ Input 0 fixed
11 to 13	P44 to P46	AN8 to AN10					
14	$\overline{\text{NMI}}$	NMIX	Input enabled	Input enabled	Input enabled	Input enabled	Input enabled
18	P00	PPG1/INT4	Output Hi-Z/ Input disabled	Output Hi-Z/ Input enabled			
19	P01	PPG2					
20	P02	PPG3/INT5			Input enabled	Input enabled	Input enabled
21 to 23	P03 to P05	TIN0 to TIN2			Retention of the immediately prior state	Retention of the immediately prior state	Output Hi-Z/ Input 0 fixed
24, 25	P06, P07	TOT1, TOT2					
26	P10	SOT0					
27	P11	SIN0					
28	P12	SCK0					
29	P13	SOT1					
30	P14	SIN1					
31	P15	SCK1					
32	P16	PPG5/INT6			Input enabled	Input enabled	Input enabled

(Continued)

MB91265 Series

(Continued)

Pin no.	Pin name	Function	At initializing		At sleep mode	At Stop mode	
			$\overline{\text{INIT}} = \text{L}^{*1}$	$\overline{\text{INIT}} = \text{H}^{*2}$		Hi-Z = 0	Hi-Z = 1
33	P17	PPG6	Output Hi-Z/ Input disabled	Output Hi-Z/ Input enabled	Retention of the immediately prior state	Retention of the immediately prior state	Output Hi-Z/ Input 0 fixed
34	P20	ADTG1/IC2					
35	P21	ADTG2/IC3					
36	P22	PWIO					
37	P23	DTTI					
38	P24	CKI					
39	P25	IC0					
40	P26	IC1					
41	P27	General port					
42	PG1	PPG0					
49	P37	PPG4					
50	P36	PPG7/INT7			Input enabled	Input enabled	Input enabled
52 to 57	P35 to P30	RTO5 to RTO0	Output Hi-Z/ Input disabled	Output Hi-Z/ Input enabled	Retention of the immediately prior state	Retention of the immediately prior state	Output Hi-Z/ Input 0 fixed
58 to 61	P40 to P43	INT0 to INT3			Input enabled	Input enabled	Input enabled

*1 : $\overline{\text{INIT}} = \text{L}$: Indicates the pin status with $\overline{\text{INIT}}$ remaining at the “L” level.

*2 : $\overline{\text{INIT}} = \text{H}$: Indicates the pin status existing immediately after $\overline{\text{INIT}}$ transition from “L” to “H” level.

■ ELECTRICAL CHARACTERISTICS

1. Absolute Maximum Ratings

Parameter	Symbol	Rating		Unit	Remarks
		Min	Max		
Power supply voltage*1	V_{CC}	$V_{SS} - 0.5$	$V_{SS} + 6.0$	V	
Analog power supply voltage*1	AV_{CC}	$V_{SS} - 0.5$	$V_{SS} + 6.0$	V	*2
Analog reference voltage*1	AV_{RH}	$V_{SS} - 0.5$	$V_{SS} + 6.0$	V	*2
Input voltage*1	V_I	$V_{SS} - 0.3$	$V_{CC} + 0.3$	V	
Analog pin input voltage*1	V_{IA}	$V_{SS} - 0.3$	$AV_{CC} + 0.3$	V	
Output voltage*1	V_O	$V_{SS} - 0.3$	$V_{CC} + 0.3$	V	
"L" level maximum output current	I_{OL}	—	10	mA	*3
"L" level average output current	I_{OLAV}	—	8	mA	*4
"L" level total maximum output current	ΣI_{OL}	—	60	mA	
"L" level total average output current	ΣI_{OLAV}	—	30	mA	*5
"H" level maximum output current	I_{OH}	—	- 10	mA	*3
"H" level average output current	I_{OHAV}	—	- 4	mA	*4
"H" level total maximum output current	ΣI_{OH}	—	- 30	mA	
"H" level total average output current	ΣI_{OHAV}	—	- 12	mA	*5
Power consumption	P_D	—	600	mW	
Operating temperature	T_a	- 40	+ 85	°C	At single chip operating
Storage temperature	T_{stg}	- 55	+ 125	°C	

*1 : The parameter is based on $V_{SS} = AV_{SS} = 0$ V.

*2 : Be careful not to exceed $V_{CC} + 0.3$ V, for example, when the power is turned on.

Be careful not to let AV_{CC} exceed V_{CC} , for example, when the power is turned on.

*3 : The maximum output current is the peak value for a single pin.

*4 : The average output current is the average current for a single pin over a period of 100 ms.

*5 : The total average output current is the average current for all pins over a period of 100 ms.

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.

MB91265 Series

2. Recommended Operating Conditions

(V_{SS} = AV_{SS} = 0 V)

Parameter	Symbol	Value		Unit	Remarks
		Min	Max		
Power supply voltage	V _{CC}	4.0	5.5	V	At normal operating
Analog power supply voltage	AV _{CC}	V _{SS} + 4.0	V _{SS} + 5.5	V	
Analog reference voltage	AVRH1	AV _{SS}	AV _{CC}	V	For A/D converter 1
	AVRH2	AV _{SS}	AV _{CC}	V	For A/D converter 2
Operating temperature	T _a	− 40	+ 85	°C	At single chip operating

Note : Upon power up, it takes approx. 100 μ s for stabilization of internal power supply after the V_{CC} power supply is stabilized. Keep applying $\overline{\text{INIT}}$ signal during that period.

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.

3. DC Characteristics

($V_{CC} = 4.0\text{ V to }5.5\text{ V}$, $V_{SS} = AV_{SS} = 0\text{ V}$)

Parameter	Symbol	Pin	Conditions	Value			Unit	Remarks
				Min	Typ	Max		
"H" level input voltage	V_{IHS}	Hysteresis input pin	—	$V_{CC} \times 0.8$	—	$V_{CC} + 0.3$	V	
"L" level input voltage	V_{ILS}	Hysteresis input pin	—	$V_{SS} - 0.3$	—	$V_{SS} \times 0.2$	V	
"H" level output voltage	V_{OH}	Other than port 30 to 35	$V_{CC} = 5.0\text{ V}$, $I_{OH} = 4.0\text{ mA}$	$V_{CC} - 0.5$	—	—	V	
	V_{OH2}	Port 30 to 35	$V_{CC} = 5.0\text{ V}$, $I_{OH} = 8.0\text{ mA}$	$V_{CC} - 0.7$	—	—	V	
"L" level output voltage	V_{OL}	Other than port 30 to 35	$V_{CC} = 5.0\text{ V}$, $I_{OL} = 4.0\text{ mA}$	—	—	0.4	V	
	V_{OL2}	Port 30 to 35	$V_{CC} = 5.0\text{ V}$, $I_{OL} = 12\text{ mA}$	—	—	0.6	V	
Input leak current	I_{LI}	—	$V_{CC} = 5.0\text{ V}$, $V_{SS} < V_I < V_{CC}$	-5	—	5	μA	
Pull-up resistance	R_{PULL}	\overline{INIT} , Pull-up pin	—	—	50	—	k Ω	
Power supply current	I_{CC}	V_{CC}	$V_{CC} = 5.0\text{ V}$, 33 MHz	—	90	100	mA	
	I_{CCS}	V_{CC}	$V_{CC} = 5.0\text{ V}$, 33 MHz	—	60	80	mA	At SLEEP
	I_{CCH}	V_{CC}	$V_{CC} = 5.0\text{ V}$, $T_a = +25\text{ }^\circ\text{C}$	—	300	—	μA	At STOP
Input capacitance	C_{IN}	Other than V_{CC} , V_{SS} , AV_{CC} , AV_{SS} , $AVRH1$, $AVRH2$	—	—	5	15	pF	

4. FLASH MEMORY write/erase characteristics

Parameter	Conditions	Value			Unit	Remarks
		Min	Typ	Max		
Sector erase time (4 Kbytes sector)	$T_a = +25\text{ }^\circ\text{C}$, $V_{CC} = 5.0\text{ V}$	—	0.2	0.5	s	Not including time for internal writing before deletion.
Byte write time	$T_a = +25\text{ }^\circ\text{C}$, $V_{CC} = 5.0\text{ V}$	—	32	3,600	μs	Not including system-level overhead time.
Erase/write cycle		10,000	—	—	Cycle	

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5. AC Characteristics

(1) Clock Timing Ratings

($V_{CC} = 4.0 \text{ V to } 5.5 \text{ V}$, $V_{SS} = AV_{SS} = 0 \text{ V}$)

Parameter	Symbol	Pin	Conditions	Value			Unit	Remarks
				Min	Typ	Max		
Clock frequency	f _c	X0 X1	—	3.6*2	—	12	MHz	For using the PLL within the self-oscillation enabled range, set the multiplier for the internal clock not to let the operating frequency exceed 33 MHz.
Clock cycle time	t _c	X0 X1		83.3	—	278*2	ns	
Input clock pulse width	P _{WH} P _{WL}	X0	—	100	—	—	ns	The standard of the duty ratio is 40 % to 60 %.
Input clock rising, falling time	t _{CF} t _{CR}	X0	—	—	—	5	ns	At external clock
Internal operating clock frequency	f _{CP}	—	When 4.125 MHz is input as the X0 clock frequency and ×8 multiplication is set for the PLL of the oscillator circuit.	2.06*1	—	33	MHz	CPU
	f _{CPP}			2.06*1	—	33	MHz	Peripheral
Internal operating clock cycle time	t _{CP}	—		30.3	—	485*1	ns	CPU
	t _{CPP}			30.3	—	485*1	ns	Peripheral

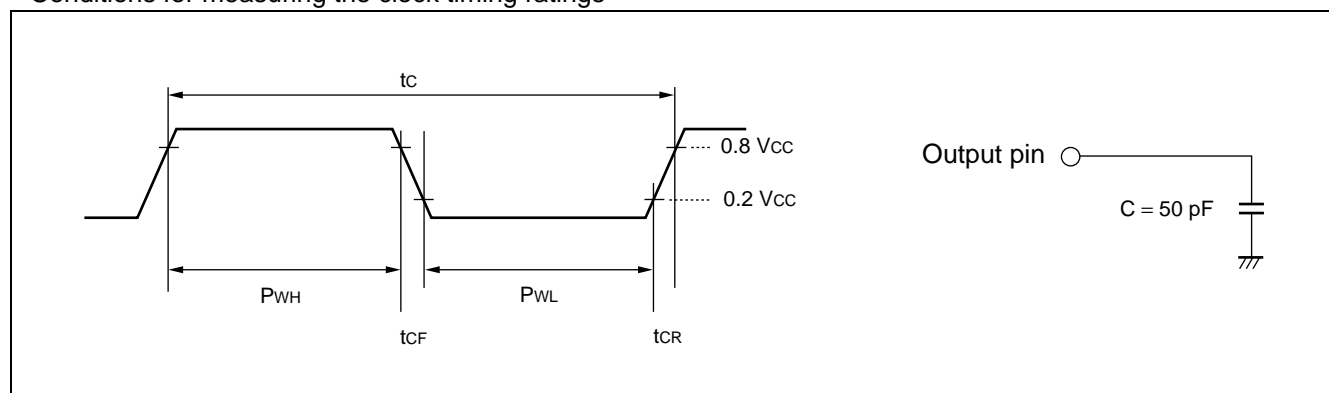
*1 : The values assume a gear cycle of 1/16.

*2 : When the PLL is used, the lower-limit frequency of the input clock to the X0 and X1 pins determines depending on the PLL multiplication.

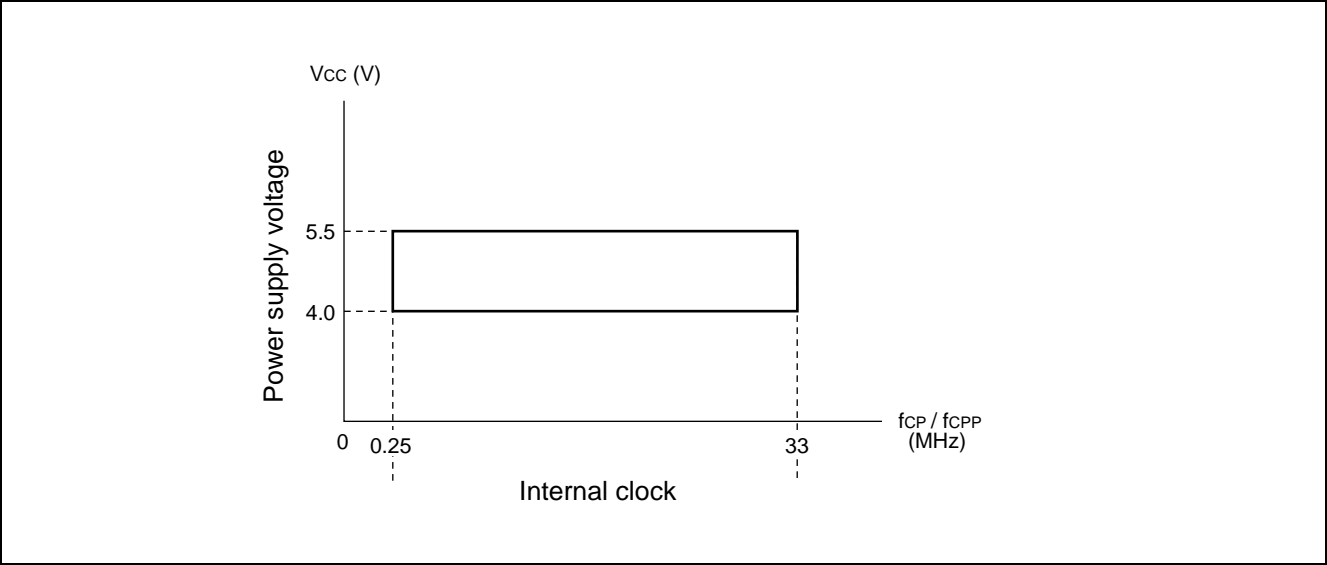
At $\times 1$ multiplication : more than 8 MHz

At $\times 2$ to $\times 8$ multiplication : more than 4 MHz

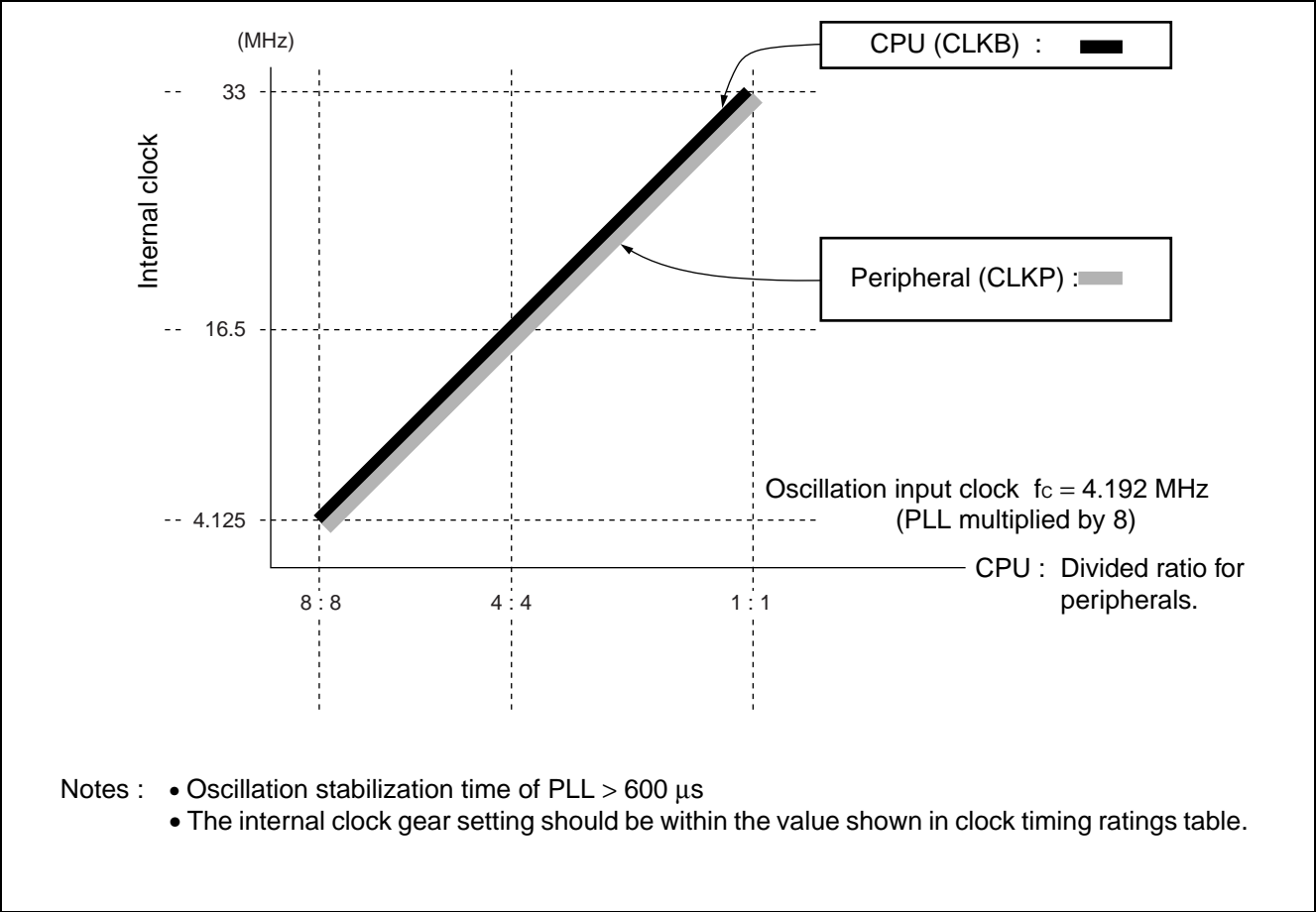
• Conditions for measuring the clock timing ratings



• Operation Assurance Range



• Internal clock setting range



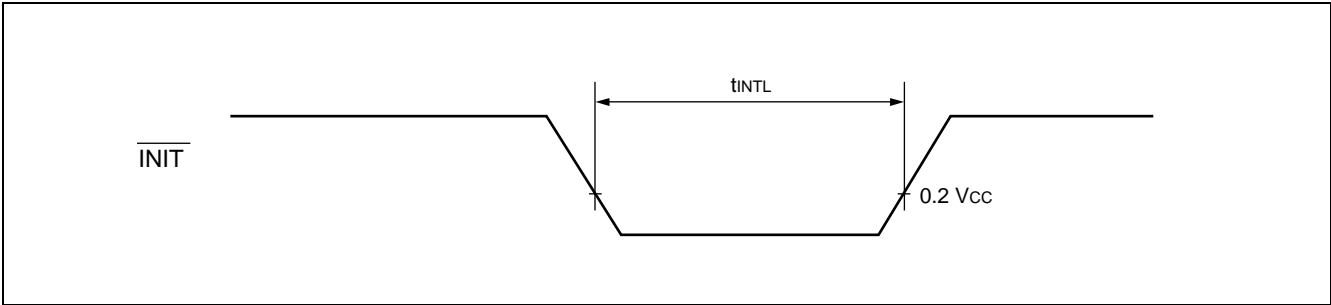
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(2) Reset Input Ratings

(V_{CC} = 4.0 V to 5.5 V, V_{SS} = AV_{SS} = 0 V)

Parameter	Sym- bol	Pin	Condi- tions	Value		Unit	Remarks
				Min	Max		
$\overline{\text{INIT}}$ input time (at power-on and STOP mode)	t _{INTL}	$\overline{\text{INIT}}$	—	Oscillation time of oscillator + t _c × 10	—	ns	*
$\overline{\text{INIT}}$ input time (other than the above)				t _c × 10	—	ns	

* : After the power is stable, L level is kept inputting to $\overline{\text{INIT}}$ for the duration of approximately 100 μs until the internal power is stabilized.



(3) UART Timing

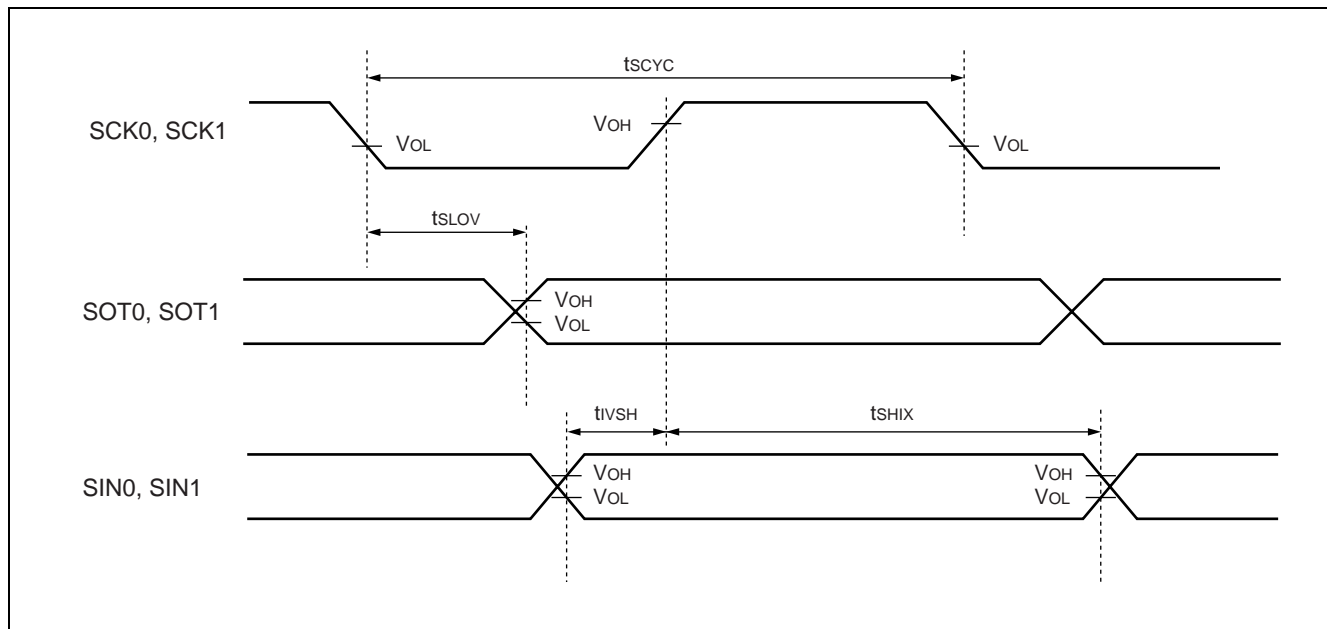
(V_{CC} = 4.0 V to 5.5 V, V_{SS} = AV_{SS} = 0 V)

Parameter	Symbol	Pin	Conditions	Value		Unit	Remarks
				Min	Max		
Serial clock cycle time	t _{SCYC}	SCK0, SCK1	Internal shift clock mode	8 t _{CYCP}	—	ns	
SCK ↓ → SOT delay time	t _{SLOV}	SCK0, SCK1, SOT0, SOT1		– 80	80	ns	
Valid SIN → SCK ↑	t _{IVSH}	SCK0, SCK1, SIN0, SIN1		100	—	ns	
SCK ↑ → valid SIN hold time	t _{SHIX}	SCK0, SCK1, SIN0, SIN1		60	—	ns	
Serial clock “H” pulse width	t _{SHSL}	SCK0, SCK1	External shift clock mode	4 t _{CYCP}	—	ns	
Serial clock “L” pulse width	t _{LSLH}	SCK0, SCK1		4 t _{CYCP}	—	ns	
SCK ↓ → SOT delay time	t _{SLOV}	SCK0, SCK1, SOT0, SOT1		—	150	ns	
Valid SIN → SCK ↑	t _{IVSH}	SCK0, SCK1, SIN0, SIN1		60	—	ns	
SCK ↑ → valid SIN hold time	t _{SHIX}	SCK0, SCK1, SIN0, SIN1		60	—	ns	

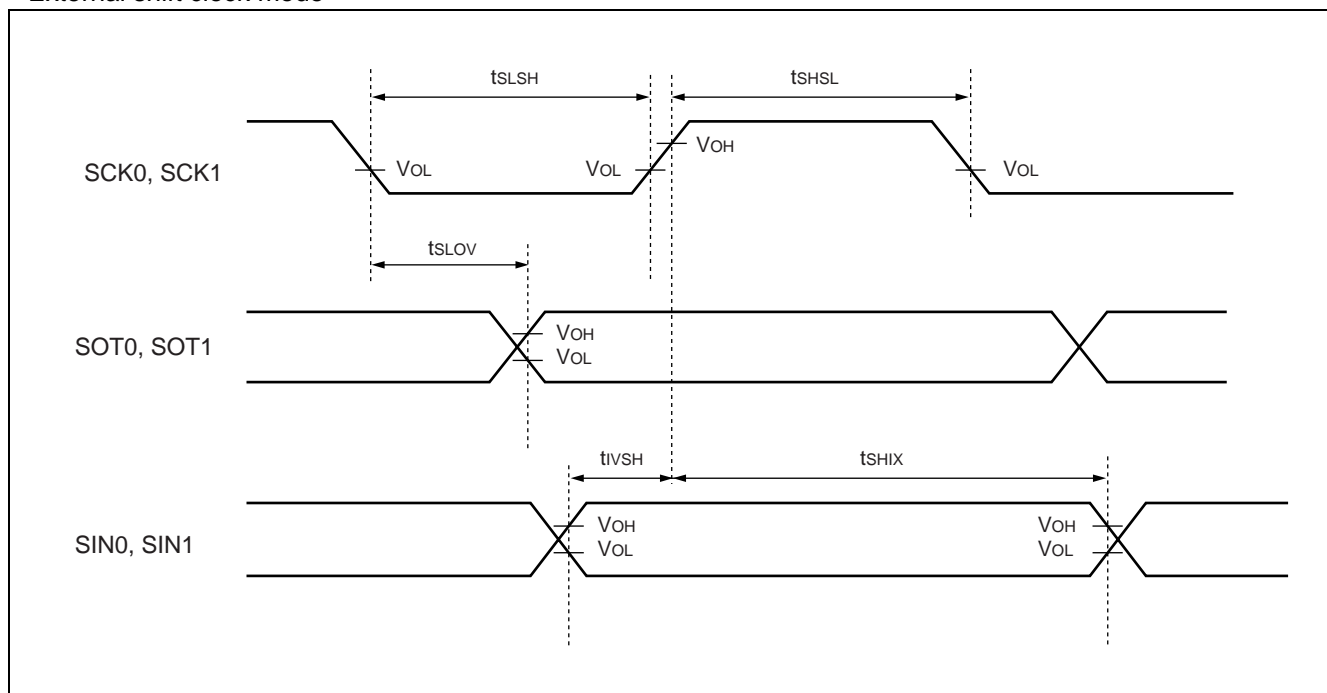
Notes : • The above ratings are the values for CLK synchronous mode.
 • t_{CYCP} indicates the peripheral clock cycle time.

MB91265 Series

- Internal shift clock mode



- External shift clock mode

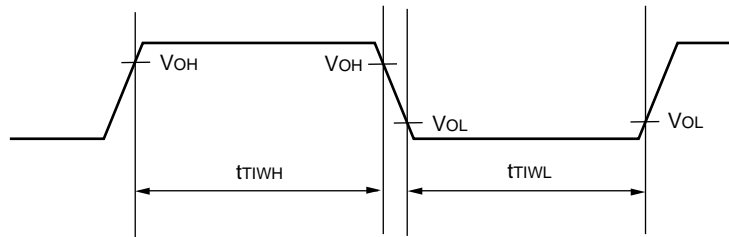


(4) Free-run Timer Clock, PWC Input, and Reload Timer Trigger Timing

($V_{CC} = 4.0\text{ V to }5.5\text{ V}$, $V_{SS} = AV_{SS} = 0\text{ V}$)

Parameter	Symbol	Pin	Conditions	Value		Unit	Remarks
				Min	Max		
Input pulse width	t_{TIWH} t_{TIWL}	CKI, PWIO, TIN0 to TIN2	—	$4\ t_{CYCP}$	—	ns	

Note : t_{CYCP} indicates the peripheral clock cycle time.

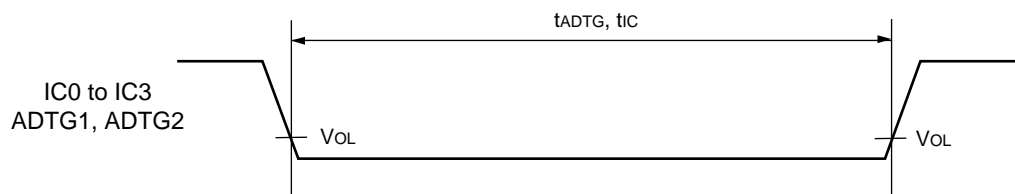


(5) Trigger Input Timing

($V_{CC} = 4.0\text{ V to }5.5\text{ V}$, $V_{SS} = AV_{SS} = 0\text{ V}$)

Parameter	Symbol	Pin	Conditions	Value		Unit	Remarks
				Min	Max		
Input capture trigger input	t_{IC}	IC0 to IC3	—	$5\ t_{CYCP}$	—	ns	
A/D activation trigger input	t_{ADTG}	ADTG1, ADTG2	—	$5\ t_{CYCP}$	—	ns	

Note : t_{CYCP} indicates the peripheral clock cycle time.



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6. Electrical Characteristics for the A/D Converter

($V_{CC} = AV_{CC} = 5.0\text{ V}$, $V_{SS} = AV_{SS} = 0\text{ V}$)

Parameter	Symbol	Pin	Value			Unit	Remarks
			Min	Typ	Max		
Resolution	—	—	—	—	10	bit	
Total error* ¹	—	—	− 4	—	4	LSB	At $AVRHn^{*4} = 5.0\text{ V}$
Linearity error* ¹	—	—	− 3.5	—	3.5	LSB	
Differential linearity error* ¹	—	—	− 3	—	3	LSB	
Zero transition voltage* ¹	V_{OT}	AN0 to AN10	$AV_{SS} - 3.5$	$AV_{SS} + 0.5$	$AV_{SS} + 4.5$	LSB	
Full transition voltage* ¹	V_{FST}	AN0 to AN10	$AVRH - 5.5$	$AVRH - 1.5$	$AVRH + 2.5$	LSB	
Conversion time	—	—	1.2* ²	—	—	μs	
Analog port Input current	I_{AIN}	AN0 to AN10	—	—	10	μA	
Analog input voltage	V_{AIN}	AN0 to AN10	AV_{SS}	—	$AVRH$	V	
Reference voltage	—	$AVRHn^{*4}$	AV_{SS}	—	AV_{CC}	V	
Analog power supply current (analog + digital)	I_A	AV_{CC}	—	2	—	mA	Per 1 unit
	I_{AH}^{*3}		—	—	100	μA	Per 1 unit
Reference power supply current (between $AVRH$ and AV_{SS})	I_R	$AVRHn^{*4}$	—	1	—	mA	Per 1 unit $AVRHn^{*4} = 5.0\text{ V}$, at $AV_{SS} = 0\text{ V}$
	I_{RH}^{*3}		—	—	100	μA	Per 1 unit at STOP
Analog input capacitance	—	—	—	10	—	pF	
Inter-channel disparity	—	AN0 to AN10	—	—	4	LSB	

*1 : Measured in the CPU sleep state

*2 : $V_{CC} = AV_{CC} = 5.0\text{ V}$, machine clock at 33 MHz

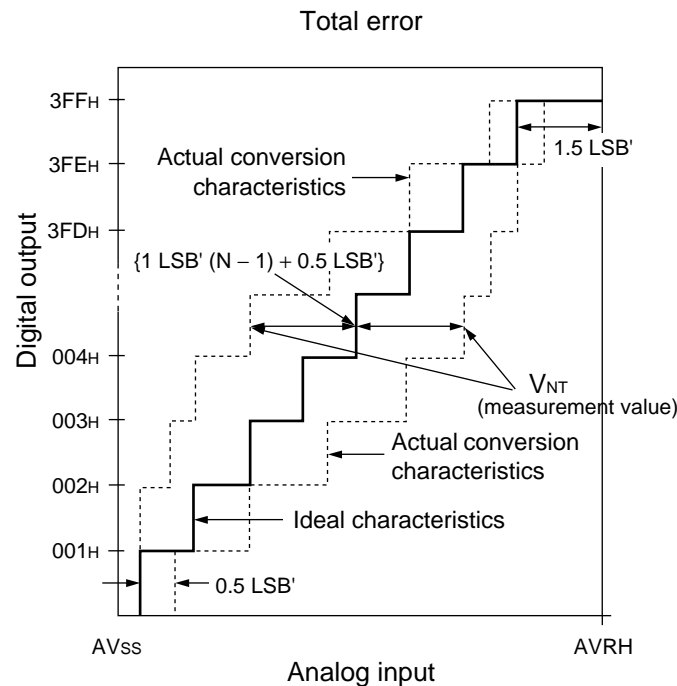
*3 : The current when the CPU is in stop mode and the A/D converter is not operating (at $V_{CC} = AV_{CC} = AVRHn = 5.0\text{ V}$)

*4: $AVRHn = AVRH1, AVRH2$

Note : The above does not guarantee the inter-unit accuracy.
Set the output impedance of the external circuit $\leq 2\text{ k}\Omega$.

Definition of A/D Converter Terms

- Resolution : Analog variation that is recognized by an A/D converter.
- Linearity error : Zero transition point (00 0000 0000 \longleftrightarrow 00 0000 0001) and full-scale transition point. Difference between the line connected (11 1111 1110 \longleftrightarrow 11 1111 1111) and actual conversion characteristics.
- Differential linearity error : Deviation of input voltage, that is required for changing output code by 1 LSB, from an ideal value.
- Total error : This error indicates the difference between actual and ideal values, including the zero transition error/full-scale transition error/linearity error.



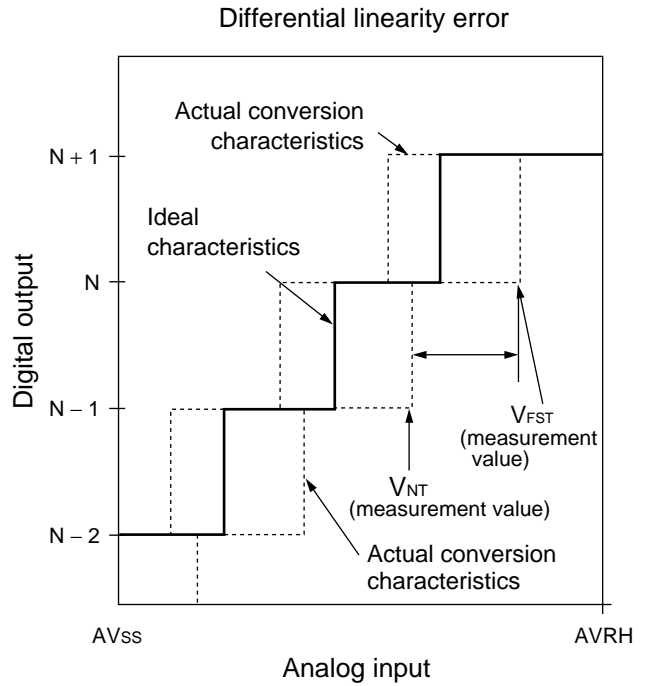
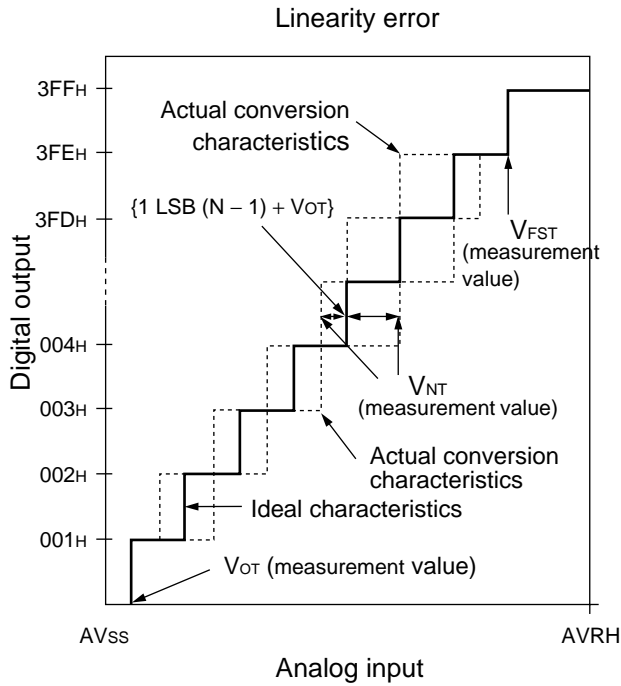
$$\begin{aligned} 1\text{LSB}' \text{ (Ideal value)} &= \frac{AVRH - AV_{SS}}{1024} \text{ [V]} \quad \text{Total error of digital output } N = \frac{V_{NT} - \{1 \text{ LSB}' \times (N - 1) + 0.5 \text{ LSB}'\}}{1 \text{ LSB}'} \end{aligned}$$

$$V_{OT}' \text{ (Ideal value)} = AV_{SS} + 0.5 \text{ LSB}' \text{ [V]}$$

$$V_{FST}' \text{ (Ideal value)} = AVRH - 1.5 \text{ LSB}' \text{ [V]} \quad V_{NT} : \text{A voltage at which digital output transits from } (N + 1) \text{ to } N.$$

(Continued)

(Continued)



$$\text{Linearity error in digital output } N = \frac{V_{NT} - \{ 1 \text{ LSB} \times (N - 1) + V_{OT} \}}{1 \text{ LSB}} [\text{LSB}]$$

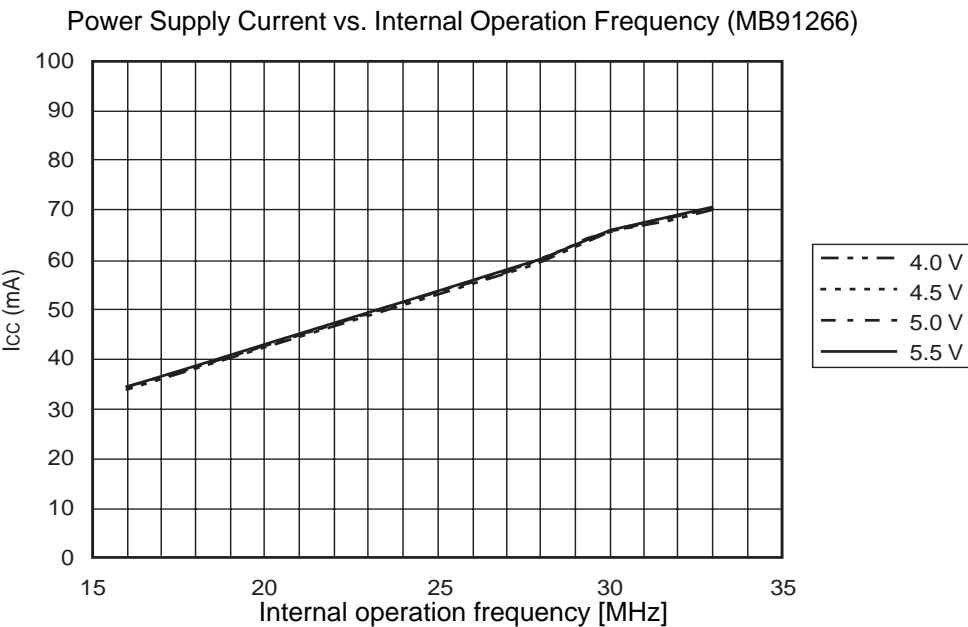
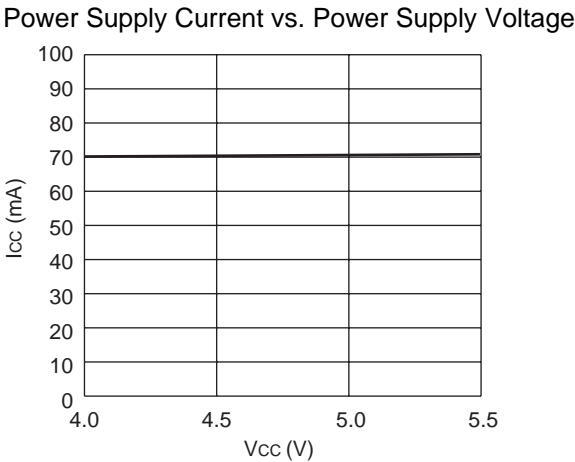
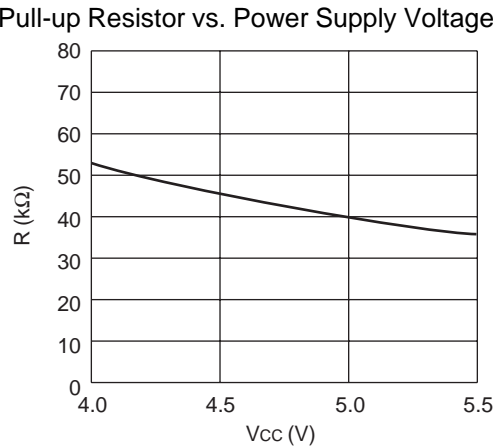
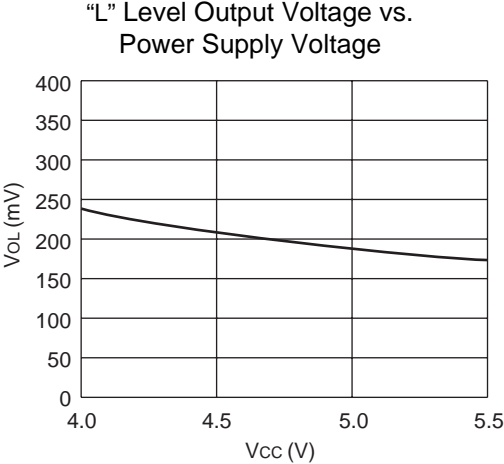
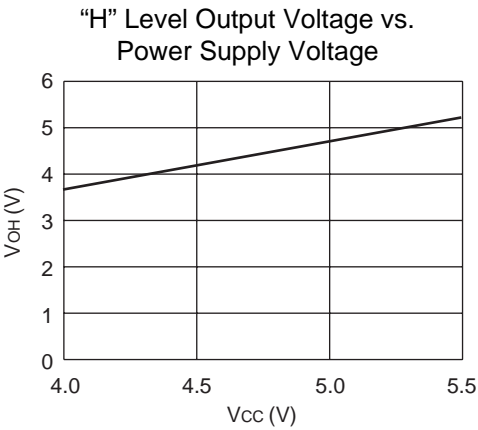
$$\text{Differential linearity error in digital output } N = \frac{V_{(N+1)T} - V_{NT}}{1 \text{ LSB}} - 1 [\text{LSB}]$$

$$1 \text{ LSB} = \frac{V_{FST} - V_{OT}}{1022} [\text{V}]$$

V_{OT} : A voltage at which digital output transits from 000_H to 001_H.

V_{FST} : A voltage at which digital output transits from 3FE_H to 3FF_H.

• Example characteristics

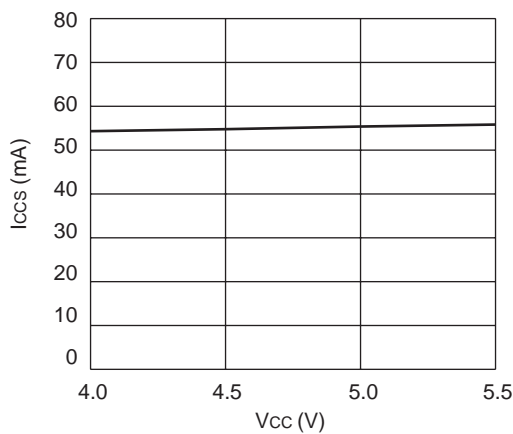


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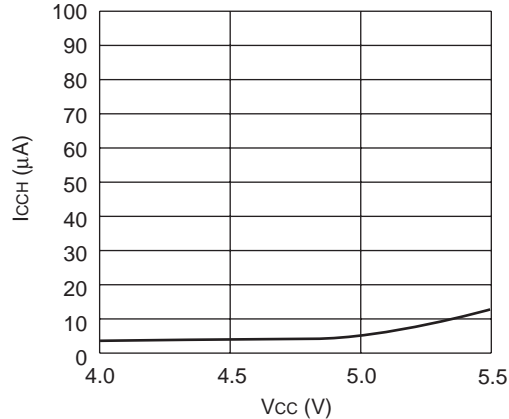
MB91265 Series

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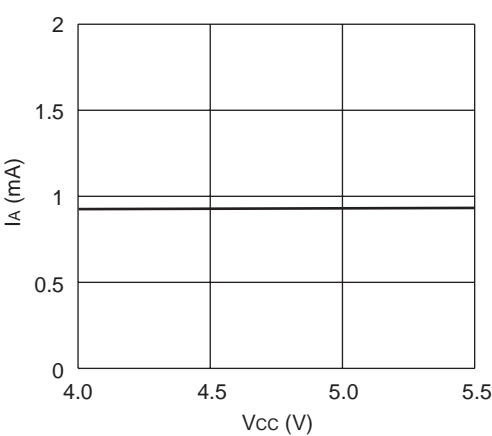
Power Supply Current (at sleep) vs.
Power Supply Voltage



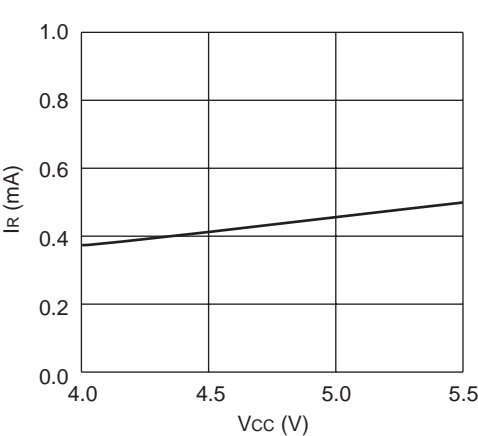
Power Supply Current (at stop) vs.
Power Supply Voltage



A/D Conversion Block Per 1 Unit (33 MHz)
Analog Power Supply Current vs.
Power Supply Voltage



A/D Conversion Block Per 1 Unit (33 MHz)
Reference Voltage Supplying Current vs.
Power Supply Voltage



■ ORDERING INFORMATION

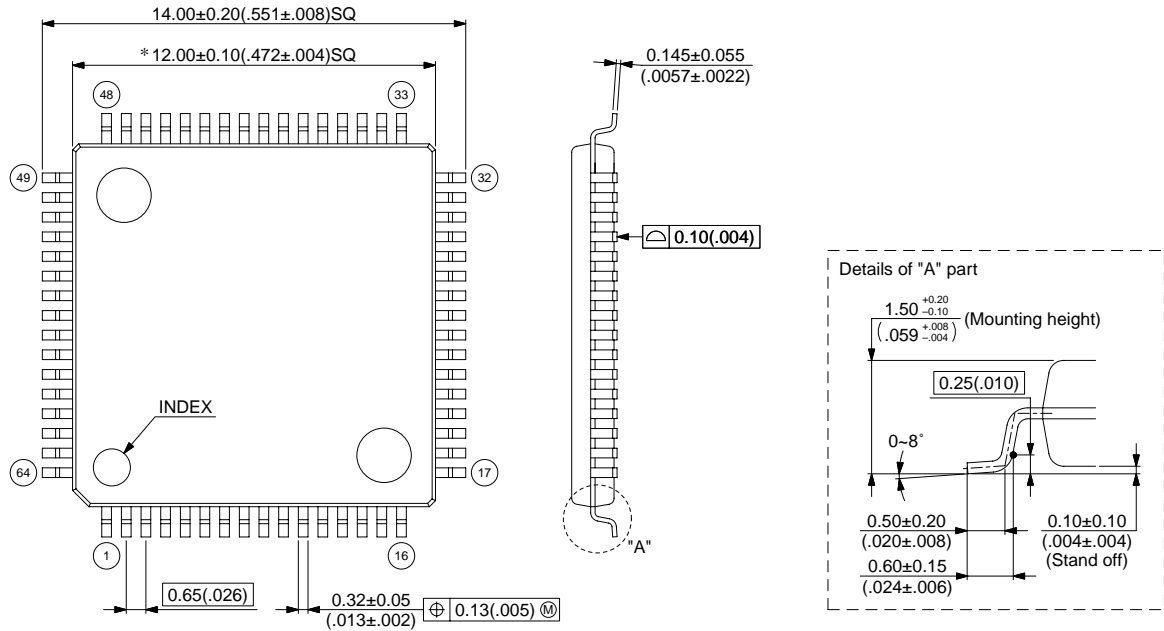
Part number	Package	Remarks
MB91266PFM-G-XXX	64-pin plastic LQFP (FPT-64P-M09)	
MB91266PFM-G-XXX-E1		Lead-free Package
MB91F267PFM-G		
MB91F267PFM-G-E1		Lead-free Package

MB91265 Series

■ PACKAGE DIMENSION

64-pin plastic LQFP
(FPT-64P-M09)

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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