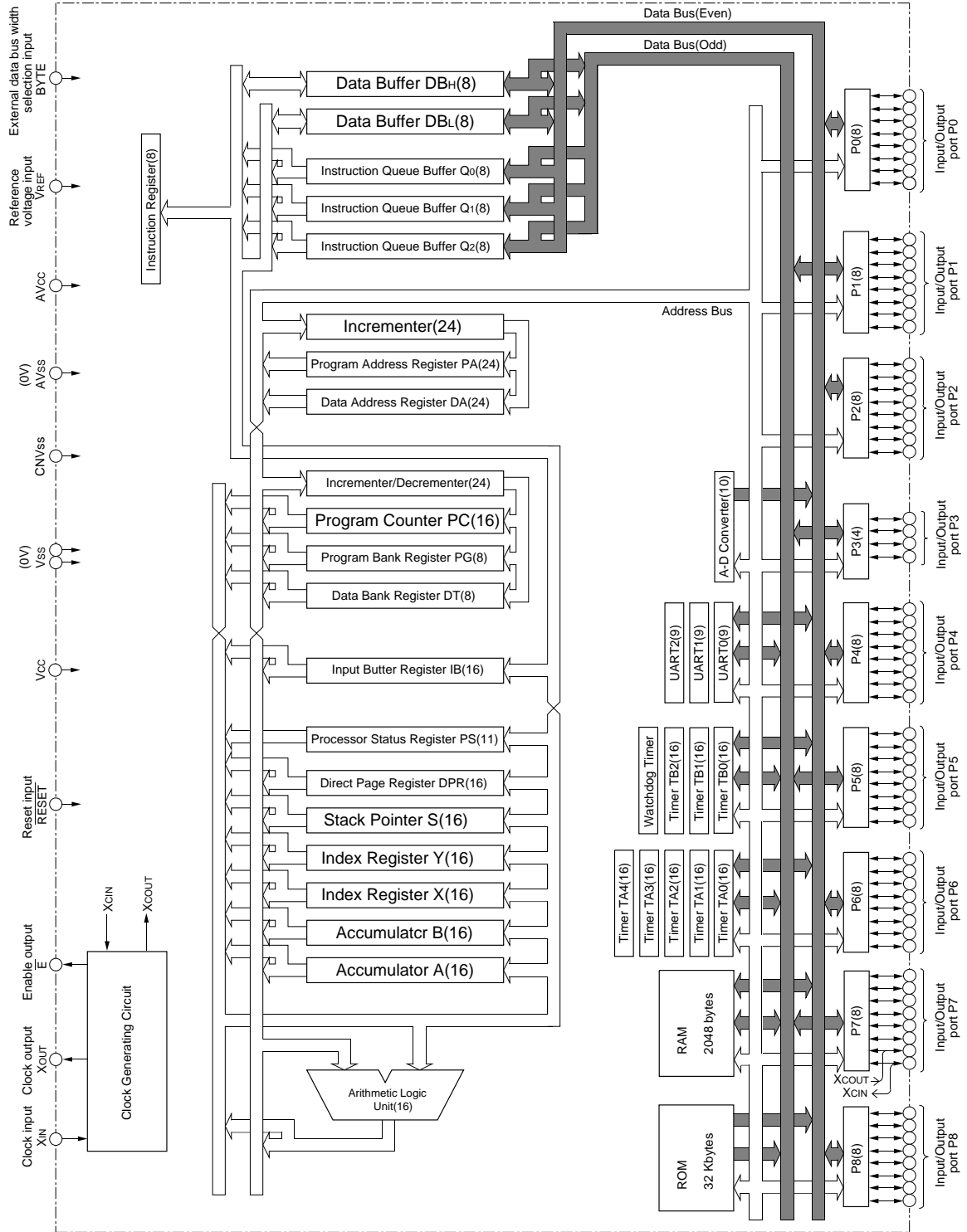


PRELIMINARY
 Notice: This is not a final specification.
 Some parametric limits are subject to change.

M37735M4BXXXFP BLOCK DIAGRAM



PRELIMINARY

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FUNCTIONS OF M37735M4BXXXFP

Parameter		Functions
Number of basic instructions		103
Instruction execution time		160 ns (the fastest instruction at external clock 25 MHz frequency)
Memory size	ROM	32 Kbytes
	RAM	2048 bytes
Input/Output ports	P0 – P2, P4 – P8	8-bit X 8
	P3	4-bit X 1
Multi-function timers	TA0, TA1, TA2, TA3, TA4	16-bit X 5
	TB0, TB1, TB2	16-bit X 3
Serial I/O		(UART or clock synchronous serial I/O) X 3
A-D converter		10-bit X 1 (8 channels)
Watchdog timer		12-bit X 1
Interrupts		3 external types, 16 internal types Each interrupt can be set to the priority level (0 – 7.)
Clock generating circuit		2 circuits built-in (externally connected to a ceramic resonator or a quartz-crystal oscillator)
Supply voltage		5 V ± 10%
Power dissipation		47.5 mW (at external clock 25 MHz frequency)
Input/Output characteristic	Input/Output voltage	5 V
	Output current	5 mA
Memory expansion		Maximum 1 Mbytes
Operating temperature range		–20 to 85 °C
Device structure		CMOS high-performance silicon gate process
Package		80-pin plastic molded QFP (80P6N-A)

PRELIMINARY
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MITSUBISHI MICROCOMPUTERS
M37735M4BXXXFP

SINGLE-CHIP 16-BIT CMOS MICROCOMPUTER

PIN DESCRIPTION

Pin	Name	Input/Output	Functions
Vcc, Vss	Power source		Apply 5 V \pm 10% to Vcc and 0 V to Vss.
CNVss	CNVss input	Input	This pin controls the processor mode. Connect to Vss for the single-chip mode and the memory expansion mode, and to Vcc for the microprocessor mode.
RESET	Reset input	Input	When "L" level is applied to this pin, the microcomputer enters the reset state.
XIN	Clock input	Input	These are pins of main-clock generating circuit. Connect a ceramic resonator or a quartz-crystal oscillator between XIN and XOUT. When an external clock is used, the clock source should be connected to the XIN pin, and the XOUT pin should be left open.
XOUT	Clock output	Output	
E	Enable output	Output	This pin functions as the enable signal output pin which indicates the access status in the internal bus. In the memory expansion mode or the microprocessor mode, this pin functions as the RDE signal output pin.
BYTE	External data bus width selection input	Input	In the memory expansion mode or the microprocessor mode, this pin determines whether the external data bus has an 8-bit width or a 16-bit width. The data bus has a 16-bit width when "L" signal is input and an 8-bit width when "H" signal is input.
AVcc, AVss	Analog power source input		Power source input pin for the A-D converter. Externally connect AVcc to Vcc and AVss to Vss.
VREF	Reference voltage input	Input	This is reference voltage input pin for the A-D converter.
P0 ₀ – P0 ₇	I/O port P0	I/O	In the single-chip mode, port P0 becomes an 8-bit I/O port. An I/O direction register is available so that each pin can be programmed for input or output. These ports are in the input mode when reset. In the memory expansion mode or the microprocessor mode, these pins output $\overline{CS_0}$ – $\overline{CS_4}$, \overline{RSMP} signals, and address (A ₁₆ , A ₁₇).
P1 ₀ – P1 ₇	I/O port P1	I/O	In the single-chip mode, these pins have the same functions as port P0. When the BYTE pin is set to "L" in the memory expansion mode or the microprocessor mode and external data bus has a 16-bit width, high-order data (D ₈ – D ₁₅) is input/output or an address (A ₈ – A ₁₅) is output. When the BYTE pin is "H" and an external data bus has an 8-bit width, only address (A ₈ – A ₁₅) is output.
P2 ₀ – P2 ₇	I/O port P2	I/O	In the single-chip mode, these pins have the same functions as port P0. In the memory expansion mode or the microprocessor mode, low-order data (D ₀ – D ₇) is input/output or an address (A ₀ – A ₇) is output.
P3 ₀ – P3 ₃	I/O port P3	I/O	In the single-chip mode, these pins have the same function as port P0. In the memory expansion mode or the microprocessor mode, \overline{WEL} , \overline{WEH} , \overline{ALE} , and \overline{HLDA} signals are output.
P4 ₀ – P4 ₇	I/O port P4	I/O	In the single-chip mode, these pins have the same functions as port P0. In the memory expansion mode or the microprocessor mode, P ₄₀ , P ₄₁ and P ₄₂ become \overline{HOLD} and \overline{RDY} input pins, and a clock ϕ_1 output pin, respectively. Functions of the other pins are the same as in the single-chip mode. However, in the memory expansion mode, P ₄₂ can be selected as an I/O port.
P5 ₀ – P5 ₇	I/O port P5	I/O	In addition to having the same functions as port P0 in the single-chip mode, these pins also function as I/O pins for timers A ₀ to A ₃ and input pins for key input interrupt input ($\overline{KI_0}$ – $\overline{KI_3}$).
P6 ₀ – P6 ₇	I/O port P6	I/O	In addition to having the same functions as port P0 in the single-chip mode, these pins also function as I/O pins for timer A ₄ , input pins for external interrupt input ($\overline{INT_0}$ – $\overline{INT_2}$) and input pins for timers B ₀ to B ₂ . P ₆₇ also functions as a sub-clock ϕ_{SUB} output pin.
P7 ₀ – P7 ₇	I/O port P7	I/O	In addition to having the same functions as port P0 in the single-chip mode, these pins function as input pins for A-D converter. P ₇₂ to P ₇₅ also function as I/O pins for UART2. Additionally, P ₇₆ and P ₇₇ have the function as the output pin (\overline{XCOUT}) and the input pin (\overline{XCIN}) of the sub-clock (32 kHz) oscillation circuit, respectively. When P ₇₆ and P ₇₇ are used as the \overline{XCOUT} and \overline{XCIN} pins, connect a resonator or an oscillator between the both.
P8 ₀ – P8 ₇	I/O port P8	I/O	In addition to having the same functions as port P0 in the single-chip mode, these pins also function as I/O pins for UART 0 and UART 1.

PRELIMINARY
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BASIC FUNCTION BLOCKS

The M37735M4BXXXFP has the same functions as the M37735MHBXXXFP except for the memory allocation and the ROM area modification function.
 Refer to the section on the M37735MHBXXXFP.

MEMORY

The memory map is shown in Figure 1. The address space has a capacity of 16 Mbytes and is allocated to addresses from 0₁₆ to FFFFFFF₁₆. The address space is divided by 64-Kbyte unit called bank. The banks are numbered from 0₁₆ to FF₁₆. However, banks 10₁₆ – FF₁₆ of the 7735 group cannot be accessed. Built-in ROM, RAM and control registers for internal peripheral devices are assigned to bank 0₁₆.
 The 32-Kbyte area from addresses 8000₁₆ to FFFF₁₆ is the built-in ROM. Addresses FFD6₁₆ to FFFF₁₆ are the RESET and interrupt vector addresses and contain the interrupt vectors. Refer to the section on interrupts for details.
 The 2048-byte area allocated to addresses from 80₁₆ to 87F₁₆ is the built-in RAM. In addition to storing data, the RAM is used as stack

during a subroutine call or interrupts.
 Peripheral devices such as I/O ports, A-D converter, serial I/O, timer, and interrupt control registers are allocated to addresses from 0₁₆ to 7F₁₆.
 Additionally, the internal ROM area can be modified by software. Refer to the section on ROM area modification function for details.
 A 256-byte direct page area can be allocated anywhere in bank 0₁₆ by using the direct page register (DPR). In the direct page addressing mode, the memory in the direct page area can be accessed with two words. Hence program steps can be reduced.

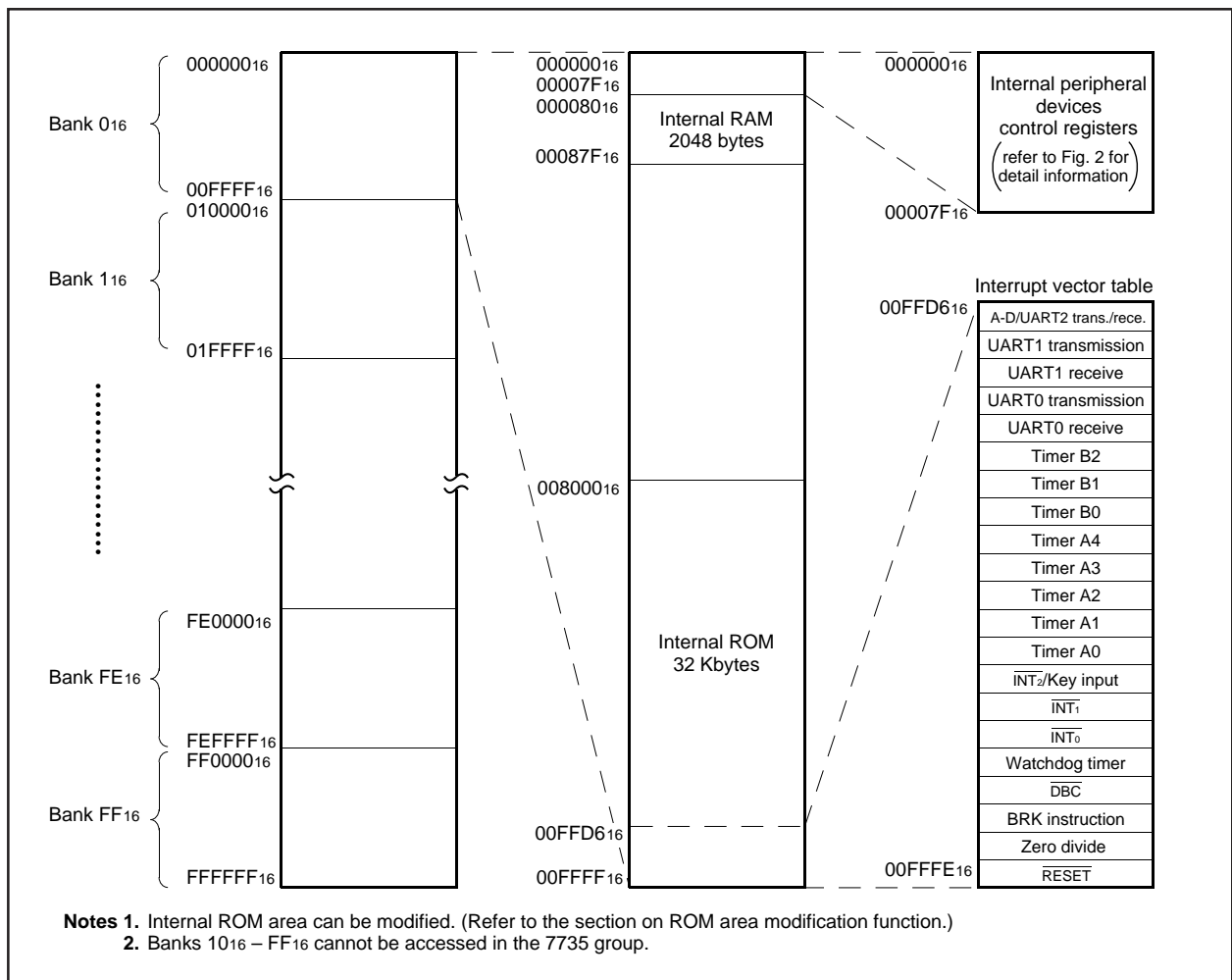


Fig. 1 Memory map

PRELIMINARY
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ROM AREA MODIFICATION FUNCTION

The internal ROM size and its address area of the M37735M4BXXXFP can be modified by the memory allocation control register's bit 0 shown in Figure 3.

Figure 5 shows the memory allocation in which the internal ROM size and its address area are modified.

Make sure to write data in the memory allocation control register as the flow shown in Figure 4.

This ROM area modification function is valid in memory expansion mode and single-chip mode.

Table 1 shows the relationship between memory allocation selection

bits and address corresponding to chip-select signals \overline{CS}_0 and \overline{CS}_1 . When ordering a mask ROM, Mitsubishi Electric corp. produces the mask ROM using the data within 32 Kbytes (addresses 008000₁₆ – 00FFFF₁₆). It is regardless of the selected ROM size (refer to MASK ROM ORDER CONFIRMATION FORM.) Therefore, program "FF₁₆" to the addresses out of the selected ROM area in the EPROM which you tender when ordering a mask ROM. Address 00FFFF₁₆ of this microcomputer corresponds to the lowest address of the EPROM which you tender.

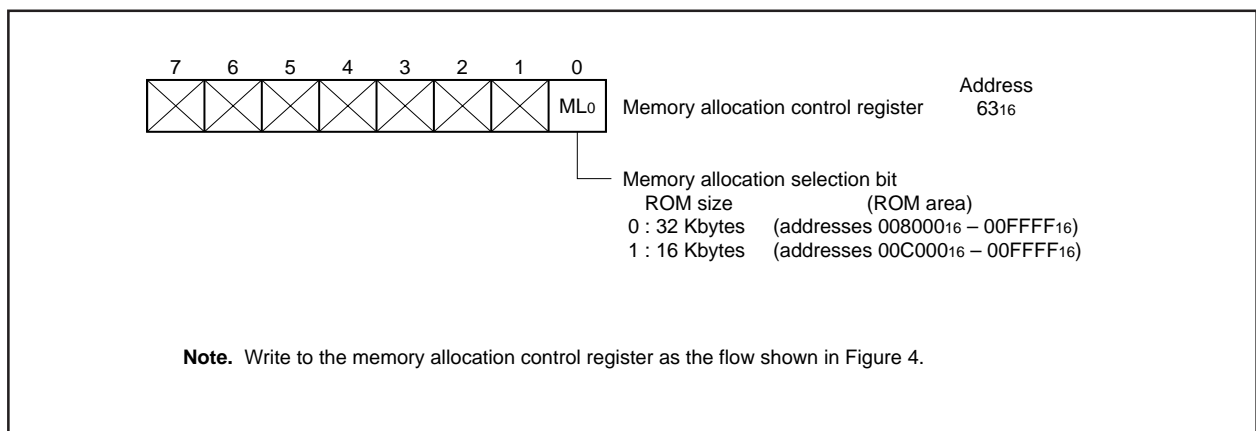


Fig. 3 Bit configuration of memory allocation control register

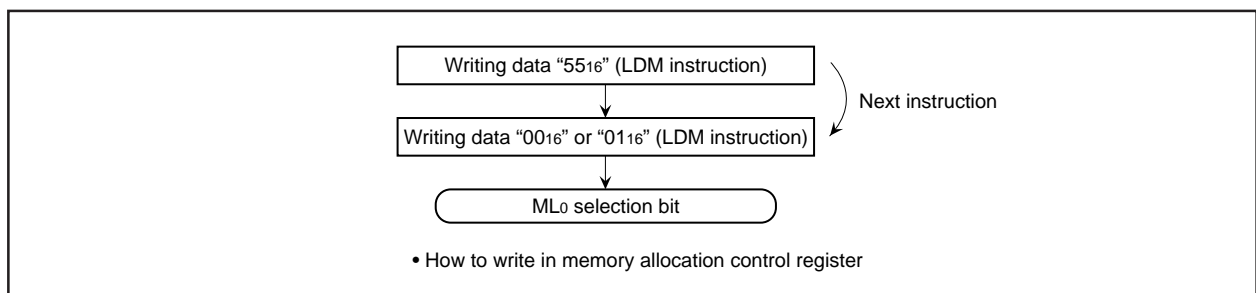


Fig. 4 How to write data in memory allocation control register

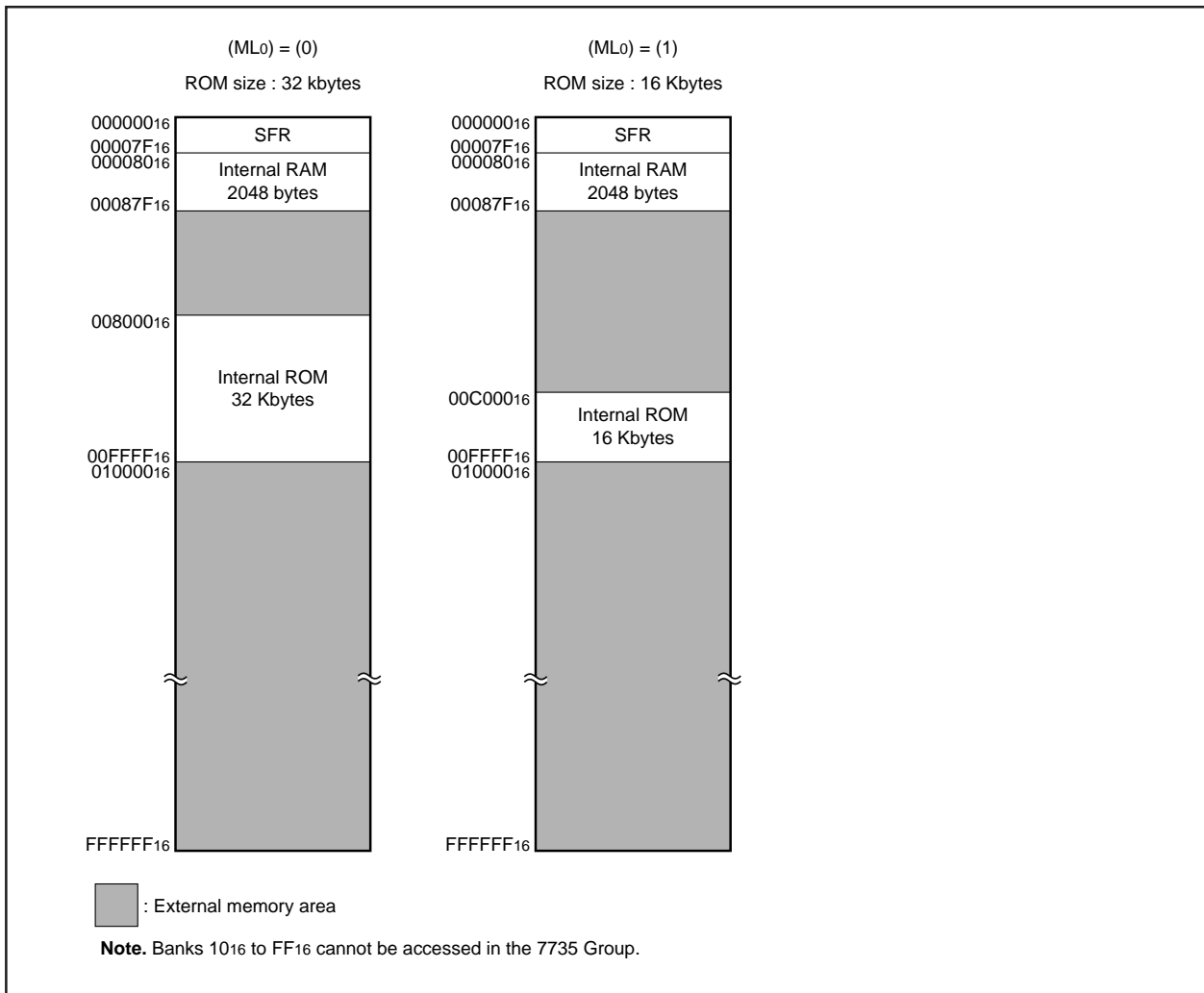


Fig. 5 Memory allocation (modification of internal ROM area by memory allocation selection bit)

Table 1. Relationship between memory allocation selection bits and addresses corresponding to chip-select signals \overline{CS}_0 and \overline{CS}_1

Memory allocation select bit ML ₀	Internal ROM area	Access address	
		\overline{CS}_0	\overline{CS}_1
0	008000 ₁₆ – 00FFFF ₁₆	000880 ₁₆ – 007FFF ₁₆	010000 ₁₆ – 03FFFF ₁₆
1	00C000 ₁₆ – 00FFFF ₁₆	000880 ₁₆ – 007FFF ₁₆	008000 ₁₆ – 00BFFF ₁₆ 010000 ₁₆ – 03FFFF ₁₆

ADDRESSING MODES

The M37735M4BXXXFP has 28 powerful addressing modes. Refer to the MITSUBISHI SEMICONDUCTORS DATA BOOK SINGLE-CHIP 16-BIT MICROCOMPUTERS for the details of each addressing mode.

MACHINE INSTRUCTION LIST

The M37735M4BXXXFP has 103 machine instructions. Refer to the

MITSUBISHI SEMICONDUCTORS DATA BOOK SINGLE-CHIP 16-BIT MICROCOMPUTERS for details.

DATA REQUIRED FOR MASK ROM ORDERING

Please send the following data for mask orders.

- (1) M37735M4BXXXFP mask ROM order confirmation form
- (2) 80P6N mark specification form
- (3) ROM data (EPROM 3 sets)

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MITSUBISHI MICROCOMPUTERS
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ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Conditions	Ratings	Unit
V _{cc}	Power source voltage		-0.3 to +7	V
AV _{cc}	Analog power source voltage		-0.3 to +7	V
V _i	Input voltage RESET, CNV _{ss} , BYTE		-0.3 to +12	V
V _i	Input voltage P00 – P07, P10 – P17, P20 – P27, P30 – P33, P40 – P47, P50 – P57, P60 – P67, P70 – P77, P80 – P87, V _{REF} , X _{IN}		-0.3 to V _{cc} + 0.3	V
V _o	Output voltage P00 – P07, P10 – P17, P20 – P27, P30 – P33, P40 – P47, P50 – P57, P60 – P67, P70 – P77, P80 – P87, X _{OUT} , E		-0.3 to V _{cc} + 0.3	V
P _d	Power dissipation	T _a = 25 °C	300	mW
T _{opr}	Operating temperature		-20 to +85	°C
T _{stg}	Storage temperature		-40 to +150	°C

RECOMMENDED OPERATING CONDITIONS (V_{cc} = 5 V ± 10%, T_a = -20 to +85 °C, unless otherwise noted)

Symbol	Parameter	Limits			Unit	
		Min.	Typ.	Max.		
V _{cc}	Power source voltage	f(X _{IN}) : Operating	4.5	5.0	5.5	V
		f(X _{IN}) : Stopped, f(X _{CIN}) = 32.768 kHz	2.7		5.5	
AV _{cc}	Analog power source voltage		V _{cc}		V	
V _{ss}	Power source voltage		0		V	
AV _{ss}	Analog power source voltage		0		V	
V _{IH}	High-level input voltage P00 – P07, P30 – P33, P40 – P47, P50 – P57, P60 – P67, P70 – P77, P80 – P87, X _{IN} , RESET, CNV _{ss} , BYTE, X _{CIN} (Note 3)	0.8 V _{cc}		V _{cc}	V	
V _{IH}	High-level input voltage P10 – P17, P20 – P27 (in single-chip mode)	0.8 V _{cc}		V _{cc}	V	
V _{IH}	High-level input voltage P10 – P17, P20 – P27 (in memory expansion mode and microprocessor mode)	0.5 V _{cc}		V _{cc}	V	
V _{IL}	Low-level input voltage P00 – P07, P30 – P33, P40 – P47, P50 – P57, P60 – P67, P70 – P77, P80 – P87, X _{IN} , RESET, CNV _{ss} , BYTE, X _{CIN} (Note 3)	0		0.2V _{cc}	V	
V _{IL}	Low-level input voltage P10 – P17, P20 – P27 (in single-chip mode)	0		0.2V _{cc}	V	
V _{IL}	Low-level input voltage P10 – P17, P20 – P27 (in memory expansion mode and microprocessor mode)	0		0.16V _{cc}	V	
I _{OH(peak)}	High-level peak output current P00 – P07, P10 – P17, P20 – P27, P30 – P33, P40 – P47, P50 – P57, P60 – P67, P70 – P77, P80 – P87			-10	mA	
I _{OH(avg)}	High-level average output current P00 – P07, P10 – P17, P20 – P27, P30 – P33, P40 – P47, P50 – P57, P60 – P67, P70 – P77, P80 – P87			-5	mA	
I _{OL(peak)}	Low-level peak output current P00 – P07, P10 – P17, P20 – P27, P30 – P33, P40 – P43, P54 – P57, P60 – P67, P70 – P77, P80 – P87			10	mA	
I _{OL(peak)}	Low-level peak output current P44 – P47, P50 – P53			20	mA	
I _{OL(avg)}	Low-level average output current P00 – P07, P10 – P17, P20 – P27, P30 – P33, P40 – P43, P54 – P57, P60 – P67, P70 – P77, P80 – P87			5	mA	
I _{OL(avg)}	Low-level average output current P44 – P47, P50 – P53			15	mA	
f(X _{IN})	Main-clock oscillation frequency (Note 4)			25	MHz	
f(X _{CIN})	Sub-clock oscillation frequency		32.768	50	kHz	

- Notes**
1. Average output current is the average value of a 100 ms interval.
 2. The sum of I_{OL(peak)} for ports P0, P1, P2, P3, and P8 must be 80 mA or less, the sum of I_{OH(peak)} for ports P0, P1, P2, P3, and P8 must be 80 mA or less, the sum of I_{OL(peak)} for ports P4, P5, P6, and P7 must be 100 mA or less, and the sum of I_{OH(peak)} for ports P4, P5, P6, and P7 must be 80 mA or less.
 3. Limits V_{IH} and V_{IL} for X_{CIN} are applied when the sub clock external input selection bit = "1".
 4. The maximum value of f(X_{IN}) = 12.5 MHz when the main clock division selection bit = "1".

PRELIMINARY
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MITSUBISHI MICROCOMPUTERS
M37735M4BXXXFP

SINGLE-CHIP 16-BIT CMOS MICROCOMPUTER

ELECTRICAL CHARACTERISTICS ($V_{CC} = 5\text{ V}$, $V_{SS} = 0\text{ V}$, $T_a = -20\text{ to }85\text{ }^\circ\text{C}$, $f(X_{IN}) = 25\text{ MHz}$, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{OH}	High-level output voltage P00 – P07, P10 – P17, P20 – P27, P33, P40 – P47, P50 – P57, P60 – P67, P70 – P77, P80 – P87	$I_{OH} = -10\text{ mA}$	3			V
V_{OH}	High-level output voltage P00 – P07, P10 – P17, P20 – P27, P33	$I_{OH} = -400\text{ }\mu\text{A}$	4.7			V
V_{OH}	High-level output voltage P30 – P32	$I_{OH} = -10\text{ mA}$	3.1			V
		$I_{CH} = -400\text{ }\mu\text{A}$	4.8			
V_{OH}	High-level output voltage \bar{E}	$I_{OH} = -10\text{ mA}$	3.4			V
		$I_{OH} = -400\text{ }\mu\text{A}$	4.8			
V_{OL}	Low-level output voltage P00 – P07, P10 – P17, P20 – P27, P33, P40 – P47, P50 – P57, P60 – P67, P70 – P77, P80 – P87	$I_{OL} = 10\text{ mA}$			2	V
V_{OL}	Low-level output voltage P44 – P47, P50 – P53	$I_{OL} = 20\text{ mA}$			2	V
V_{OL}	Low-level output voltage P00 – P07, P10 – P17, P20 – P27, P33	$I_{OL} = 2\text{ mA}$			0.45	V
V_{OL}	Low-level output voltage P30 – P32	$I_{OL} = 10\text{ mA}$			1.9	V
		$I_{OL} = 2\text{ mA}$			0.43	
V_{OL}	Low-level output voltage \bar{E}	$I_{OL} = 10\text{ mA}$			1.6	V
		$I_{OL} = 2\text{ mA}$			0.4	
$V_{T+} - V_{T-}$	Hysteresis HOLD, RDY, TA0IN – TA4IN, TB0IN – TB2IN, INT0 – INT2, ADTRG, CTS0, CTS1, CTS2, CLK0, CLK1, CLK2, K10 – K13		0.4		1	V
$V_{T+} - V_{T-}$	Hysteresis RESET		0.2		0.5	V
$V_{T+} - V_{T-}$	Hysteresis XIN		0.1		0.4	V
$V_{T+} - V_{T-}$	Hysteresis XCIN (When external clock is input)		0.1		0.4	V
I_{IH}	High-level input current P00 – P07, P10 – P17, P20 – P27, P30 – P33, P40 – P47, P50 – P57, P60 – P67, P70 – P77, P80 – P87, XIN, RESET, CNVss, BYTE	$V_i = 5\text{ V}$			5	μA
I_{iL}	Low-level input current P00 – P07, P10 – P17, P20 – P27, P30 – P33, P40 – P47, P50 – P53, P60, P61, P65 – P67, P70 – P77, P80 – P87, XIN, RESET, CNVss, BYTE	$V_i = 0\text{ V}$			-5	μA
I_{iL}	Low-level input current P54 – P57, P62 – P64	$V_i = 0\text{ V}$, without a pull-up transistor			-5	μA
		$V_i = 0\text{ V}$, with a pull-up transistor	-0.25	-0.5	-1.0	mA
V_{RAM}	RAM hold voltage	When clock is stopped.	2			V

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ELECTRICAL CHARACTERISTICS ($V_{CC} = 5\text{ V}$, $V_{SS} = 0\text{ V}$, $T_a = -20\text{ to }85\text{ }^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit		
			Min.	Typ.	Max.			
I _{CC}	Power source current	In single-chip mode, output pins are open, and other pins are V _{SS} .	V _{CC} = 5 V, f(X _{IN}) = 25 MHz (square waveform), f(f ₂) = 12.5 MHz, f(X _{CIN}) = 32.768 kHz, in operating (Note 1)		9.5	19	mA	
			V _{CC} = 5 V, f(X _{IN}) = 25 MHz (square waveform), f(f ₂) = 1.5625 MHz, f(X _{CIN}) = Stopped, in operating (Note 1)		1.3	2.6	mA	
			V _{CC} = 5V, f(X _{IN}) = 25 MHz (square waveform), f(X _{CIN}) = 32.768 kHz, when a WIT instruction is executed (Note 2)		10	20	μA	
			V _{CC} = 5 V, f(X _{IN}) : Stopped, f(X _{CIN}) : 32.768 kHz, in operating (Note 3)		50	100	μA	
			V _{CC} = 5 V, f(X _{IN}) : Stopped, f(X _{CIN}) : 32.768 kHz, when a WIT instruction is executed (Note 4)		5	10	μA	
			T _a = 25 °C, when clock is stopped				1	μA
			T _a = 85 °C, when clock is stopped				20	μA

- Notes**
1. This applies when the main clock external input selection bit = "1", the main clock division selection bit = "0", and the signal output stop bit = "1".
 2. This applies when the main clock external input selection bit = "1" and the system clock stop bit at wait state = "1".
 3. This applies when CPU and the clock timer are operating with the sub clock (32.768 kHz) selected as the system clock.
 4. This applies when the X_{COUT} drivability selection bit = "0" and the system clock stop bit at wait state = "1".

A-D CONVERTER CHARACTERISTICS

($V_{CC} = AV_{CC} = 5\text{ V}$, $V_{SS} = AV_{SS} = 0\text{ V}$, $T_a = -20\text{ to }85\text{ }^\circ\text{C}$, $f(X_{IN}) = 25\text{ MHz}$ (Note), unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
—	Resolution	V _{REF} = V _{CC}			10	Bits
—	Absolute accuracy	V _{REF} = V _{CC}			± 3	LSB
R _{LADDER}	Ladder resistance	V _{REF} = V _{CC}	10		25	kΩ
t _{CONV}	Conversion time		9.44			μs
V _{REF}	Reference voltage		2		V _{CC}	V
V _{IA}	Analog input voltage		0		V _{REF}	V

Note. This applies when the main clock division selection bit = "0" and f(f₂) = 12.5 MHz.

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MITSUBISHI MICROCOMPUTERS
M37735M4BXXXFP

SINGLE-CHIP 16-BIT CMOS MICROCOMPUTER

TIMING REQUIREMENTS ($V_{CC} = 5\text{ V} \pm 10\%$, $V_{SS} = 0\text{ V}$, $T_a = -20\text{ to }85\text{ }^\circ\text{C}$, $f(X_{IN}) = 25\text{ MHz}$, unless otherwise noted (Note))

Notes 1. This applies when the main clock division selection bit = "0" and $f(f_2) = 12.5\text{ MHz}$.

2. Input signal's rise/fall time must be 100 ns or less, unless otherwise noted.

External clock input

Symbol	Parameter	Limits		Unit
		Min.	Max.	
t_c	External clock input cycle time (Note 3)	40		ns
$t_{w(H)}$	External clock input high-level pulse width (Note 4)	15		ns
$t_{w(L)}$	External clock input low-level pulse width (Note 4)	15		ns
t_r	External clock rise time		8	ns
t_f	External clock fall time		8	ns

Notes 3. When the main clock division selection bit = "1", the minimum value of $t_c = 80\text{ ns}$.

4. When the main clock division selection bit = "1", values of $t_{w(H)} / t_c$ and $t_{w(L)} / t_c$ must be set to values from 0.45 through 0.55.

Single-chip mode

Symbol	Parameter	Limits		Unit
		Min.	Max.	
$t_{su}(P0D-E)$	Port P0 input setup time	60		ns
$t_{su}(P1D-E)$	Port P1 input setup time	60		ns
$t_{su}(P2D-E)$	Port P2 input setup time	60		ns
$t_{su}(P3D-E)$	Port P3 input setup time	60		ns
$t_{su}(P4D-E)$	Port P4 input setup time	60		ns
$t_{su}(P5D-E)$	Port P5 input setup time	60		ns
$t_{su}(P6D-E)$	Port P6 input setup time	60		ns
$t_{su}(P7D-E)$	Port P7 input setup time	60		ns
$t_{su}(P8D-E)$	Port P8 input setup time	60		ns
$t_h(E-P0D)$	Port P0 input hold time	0		ns
$t_h(E-P1D)$	Port P1 input hold time	0		ns
$t_h(E-P2D)$	Port P2 input hold time	0		ns
$t_h(E-P3D)$	Port P3 input hold time	0		ns
$t_h(E-P4D)$	Port P4 input hold time	0		ns
$t_h(E-P5D)$	Port P5 input hold time	0		ns
$t_h(E-P6D)$	Port P6 input hold time	0		ns
$t_h(E-P7D)$	Port P7 input hold time	0		ns
$t_h(E-P8D)$	Port P8 input hold time	0		ns

Memory expansion mode and microprocessor mode

Symbol	Parameter	Limits		Unit
		Min.	Max.	
$t_{su}(D-RDE)$	Data input setup time	32		ns
$t_{su}(RDY-\phi_1)$	RDY input setup time	55		ns
$t_{su}(HOLD-\phi_1)$	HOLD input setup time	55		ns
$t_h(RDE-D)$	Data input hold time	0		ns
$t_h(\phi_1-RDY)$	RDY input hold time	0		ns
$t_h(\phi_1-HOLD)$	HOLD input hold time	0		ns

PRELIMINARY
 Notice: This is not a final specification.
 Some parametric limits are subject to change.

Timer A input (Count input in event counter mode)

Symbol	parameter	Limits		Unit
		Min.	Max.	
t _c (TA)	TAiIN input cycle time	80		ns
t _w (TAH)	TAiIN input high-level pulse width	40		ns
t _w (TAL)	TAiIN input low-level pulse width	40		ns

Timer A input (Gating input in timer mode)

Symbol	parameter	Limits		Unit
		Min.	Max.	
t _c (TA)	TAiIN input cycle time (Note)	320		ns
t _w (TAH)	TAiIN input high-level pulse width (Note)	160		ns
t _w (TAL)	TAiIN input low-level pulse width (Note)	160		ns

Note. Limits change depending on f(XIN). Refer to "DATA FORMULAS".

Timer A input (External trigger input in one-shot pulse mode)

Symbol	parameter	Limits		Unit
		Min.	Max.	
t _c (TA)	TAiIN input cycle time (Note)	320		ns
t _w (TAH)	TAiIN input high-level pulse width	80		ns
t _w (TAL)	TAiIN input low-level pulse width	80		ns

Note. Limits change depending on f(XIN). Refer to "DATA FORMULAS".

Timer A input (External trigger input in pulse width modulation mode)

Symbol	parameter	Limits		Unit
		Min.	Max.	
t _w (TAH)	TAiIN input high-level pulse width	80		ns
t _w (TAL)	TAiIN input low-level pulse width	80		ns

Timer A input (Up-down input in event counter mode)

Symbol	parameter	Limits		Unit
		Min.	Max.	
t _c (UP)	TAiOUT input cycle time	2000		ns
t _w (UPH)	TAiOUT input high-level pulse width	1000		ns
t _w (UPL)	TAiOUT input low-level pulse width	1000		ns
t _{su} (UP-TIN)	TAiOUT input setup time	400		ns
t _h (TIN-UP)	TAiOUT input hold time	400		ns

Timer A input (Two-phase pulse input in event counter mode)

Symbol	parameter	Limits		Unit
		Min.	Max.	
t _c (TA)	TAjIN input cycle time	800		ns
t _{su} (TAjIN-TAjOUT)	TAjIN input setup time	200		ns
t _{su} (TAjOUT-TAjIN)	TAjOUT input setup time	200		ns

Timer B input (Count input in event counter mode)

Symbol	Parameter	Limits		Unit
		Min.	Max.	
t _c (TB)	TBiIN input cycle time (one edge count)	80		ns
t _w (TBH)	TBiIN input high-level pulse width (one edge count)	40		ns
t _w (TBL)	TBiIN input low-level pulse width (one edge count)	40		ns
t _c (TB)	TBiIN input cycle time (both edges count)	160		ns
t _w (TBH)	TBiIN input high-level pulse width (both edges count)	80		ns
t _w (TBL)	TBiIN input low-level pulse width (both edges count)	80		ns

Timer B input (Pulse period measurement mode)

Symbol	Parameter	Limits		Unit
		Min.	Max.	
t _c (TB)	TBiIN input cycle time (Note)	320		ns
t _w (TBH)	TBiIN input high-level pulse width (Note)	160		ns
t _w (TBL)	TBiIN input low-level pulse width (Note)	160		ns

Note. Limits change depending on f(X_{IN}). Refer to "DATA FORMULAS".

Timer B input (Pulse width measurement mode)

Symbol	Parameter	Limits		Unit
		Min.	Max.	
t _c (TB)	TBiIN input cycle time (Note)	320		ns
t _w (TBH)	TBiIN input high-level pulse width (Note)	160		ns
t _w (TBL)	TBiIN input low-level pulse width (Note)	160		ns

Note. Limits change depending on f(X_{IN}). Refer to "DATA FORMULAS".

A-D trigger input

Symbol	Parameter	Limits		Unit
		Min.	Max.	
t _c (AD)	ADTRG input cycle time (minimum allowable trigger)	1000		ns
t _w (ADL)	ADTRG input low-level pulse width	125		ns

Serial I/O

Symbol	Parameter	Limits		Unit
		Min.	Max.	
t _c (CK)	CLK _i input cycle time	200		ns
t _w (CKH)	CLK _i input high-level pulse width	100		ns
t _w (CKL)	CLK _i input low-level pulse width	100		ns
t _d (C-Q)	TxD _i output delay time		80	ns
t _h (C-Q)	TxD _i hold time	0		ns
t _{su} (D-C)	RxD _i input setup time	30		ns
t _h (C-D)	RxD _i input hold time	90		ns

External interrupt INT_i input, key input interrupt KI_i input

Symbol	Parameter	Limits		Unit
		Min.	Max.	
t _w (INH)	INT _i input high-level pulse width	250		ns
t _w (INL)	INT _i input low-level pulse width	250		ns
t _w (KIL)	KI _i input low-level pulse width	250		ns

PRELIMINARY
 Notice: This is not a final specification.
 Some parametric limits are subject to change.

DATA FORMULAS

Timer A input (Gating input in timer mode)

Symbol	Parameter	Limits		Unit
		Min.	Max.	
t _{c(TA)}	TAiIn input cycle time	$\frac{8 \times 10^9}{2 \cdot f(f_2)}$		ns
t _{w(TAH)}	TAiIn input high-level pulse width	$\frac{4 \times 10^9}{2 \cdot f(f_2)}$		ns
t _{w(TAL)}	TAiIn input low-level pulse width	$\frac{4 \times 10^9}{2 \cdot f(f_2)}$		ns

Timer A input (External trigger input in one-shot pulse mode)

Symbol	Parameter	Limits		Unit
		Min.	Max.	
t _{c(TA)}	TAiIn input cycle time	$\frac{8 \times 10^9}{2 \cdot f(f_2)}$		ns

Timer B input (In pulse period measurement mode or pulse width measurement mode)

Symbol	Parameter	Limits		Unit
		Min.	Max.	
t _{c(TB)}	TBiIn input cycle time	$\frac{8 \times 10^9}{2 \cdot f(f_2)}$		ns
t _{w(TBH)}	TBiIn input high-level pulse width	$\frac{4 \times 10^9}{2 \cdot f(f_2)}$		ns
t _{w(TBL)}	TBiIn input low-level pulse width	$\frac{4 \times 10^9}{2 \cdot f(f_2)}$		ns

Note. f(f₂) represents the clock f₂ frequency.

For the relation to the main clock and sub clock, refer to Table 10 in data sheet "M37735MHBXXXFP".

PRELIMINARY
 Notice: This is not a final specification.
 Some parametric limits are subject to change.

SWITCHING CHARACTERISTICS ($V_{CC} = 5\text{ V} \pm 10\%$, $V_{SS} = 0\text{ V}$, $T_a = -20\text{ to }85^\circ\text{C}$, $f(X_{IN}) = 25\text{ MHz}$ (Note), unless otherwise noted)

Symbol	Parameter	Test conditions	Limits		Unit
			Min.	Max.	
$t_d(E-P0Q)$	Port P0 data output delay time	Fig. 6		80	ns
$t_d(E-P1Q)$	Port P1 data output delay time			80	ns
$t_d(E-P2Q)$	Port P2 data output delay time			80	ns
$t_d(E-P3Q)$	Port P3 data output delay time			80	ns
$t_d(E-P4Q)$	Port P4 data output delay time			80	ns
$t_d(E-P5Q)$	Port P5 data output delay time			80	ns
$t_d(E-P6Q)$	Port P6 data output delay time			80	ns
$t_d(E-P7Q)$	Port P7 data output delay time			80	ns
$t_d(E-P8Q)$	Port P8 data output delay time			80	ns

Note. This applies when the main clock division selection bit = "0" and $f(f_2) = 12.5\text{ MHz}$.

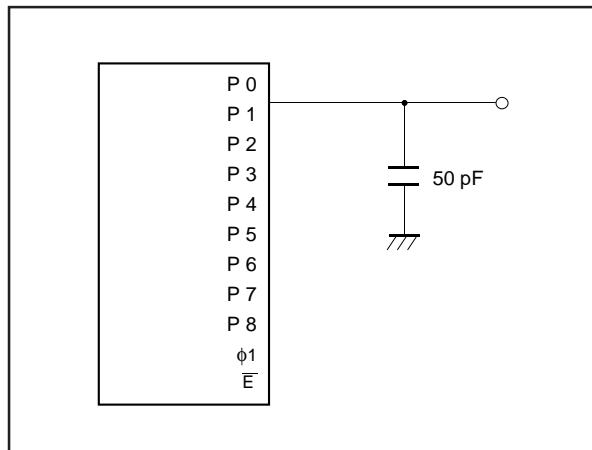


Fig. 6 Measuring circuit for ports P0 – P8 and ϕ_1

PRELIMINARY
 Notice: This is not a final specification.
 Some parametric limits are subject to change.

Memory expansion mode and microprocessor mode

(V_{CC} = 5 V ± 10%, V_{SS} = 0 V, T_a = 25 °C, f(X_{IN}) = 25 MHz (Note 1), unless otherwise noted)

Symbol	Parameter	(Note 2) Wait mode	Test conditions	Limits		Unit
				Min.	Max.	
td(CS-WE) td(CS-RDE)	Chip-select output delay time	No wait	Fig. 6	12		ns
		Wait 1		87		ns
		Wait 0				
th(WE-CS) th(RDE-CS)	Chip-select hold time			4		ns
td(A _n -WE) td(A _n -RDE)	Address output delay time	No wait		12		ns
		Wait 1		87		ns
		Wait 0				
td(A-WE) td(A-RDE)	Address output delay time	No wait		12		ns
		Wait 1		75		ns
		Wait 0				
th(WE-A _n) th(RDE-A _n)	Address hold time			18		ns
tw(ALE)	ALE pulse width	No wait	22		ns	
		Wait 1	57		ns	
		Wait 0				
tsu(A-ALE)	Address output set up time	No wait	5		ns	
		Wait 1	45		ns	
		Wait 0				
th(ALE-A)	Address hold time	No wait	9		ns	
		Wait 1	15		ns	
		Wait 0				
td(ALE-WE) td(ALE-RDE)	ALE output delay time	No wait	4		ns	
		Wait 1	10		ns	
		Wait 0				
td(WE-DQ)	Data output delay time			45	ns	
th(WE-DQ)	Data hold delay time			18	ns	
tw(WE)	WEL/WEH pulse width	No wait	50		ns	
		Wait 1	130		ns	
		Wait 0				
tpxz(RDE-DZ)	Floating start delay time			5	ns	
tpzx(RDE-DZ)	Floating release delay time			20	ns	
tw(RDE)	RDE pulse width	No wait	48		ns	
		Wait 1	128		ns	
		Wait 0				
td(RSMP-WE) td(RSMP-RDE)	RSMP output delay time		10		ns	
th(φ ₁ -RSMP)		RSMP hold time		0		ns
td(WE-φ ₁) td(RDE-φ ₁)	φ ₁ output delay time		0	18	ns	
td(φ ₁ -HLDA)		HLDA output delay time			50	ns

Notes 1. This applies when the main clock division selection bit = "0" and f(f₂) = 12.5 MHz.

2. No wait : Wait bit = "1".

Wait 1 : The external memory area is accessed with wait bit = "0" and wait selection bit = "1".

Wait 0 : The external memory area is accessed with wait bit = "0" and wait selection bit = "0".

PRELIMINARY
 Notice: This is not a final specification.
 Some parametric limits are subject to change.

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Memory expansion mode and microprocessor mode

Bus timing data formulas ($V_{CC} = 5\text{ V} \pm 10\%$, $V_{SS} = 0\text{ V}$, $T_a = -20\text{ to }85\text{ }^\circ\text{C}$, $f(X_{IN}) = 25\text{ MHz}$ (Max., Note1), unless otherwise noted)

Symbol	Parameter	Wait mode	Limits		Unit
			Min.	Max.	
td(CS–WE) td(CS–RDE)	Chip-select output delay time	No wait	$\frac{1 \times 10^9}{2 \cdot f(f_2)} - 28$		ns
		Wait 1	$\frac{3 \times 10^9}{2 \cdot f(f_2)} - 33$		ns
th(WE–CS) th(RDE–CS)	Chip-select hold time		4		ns
td(An–WE) td(An–RDE)	Address output delay time	No wait	$\frac{1 \times 10^9}{2 \cdot f(f_2)} - 28$		ns
		Wait 1	$\frac{3 \times 10^9}{2 \cdot f(f_2)} - 33$		ns
td(A–WE) td(A–RDE)	Address output delay time	No wait	$\frac{1 \times 10^9}{2 \cdot f(f_2)} - 28$		ns
		Wait 1	$\frac{3 \times 10^9}{2 \cdot f(f_2)} - 45$		ns
th(WE–An) th(RDE–An)	Address hold time		$\frac{1 \times 10^9}{2 \cdot f(f_2)} - 22$		ns
tw(ALE)	ALE pulse width	No wait	$\frac{1 \times 10^9}{2 \cdot f(f_2)} - 18$		ns
		Wait 1	$\frac{2 \times 10^9}{2 \cdot f(f_2)} - 23$		ns
tsu(A–ALE)	Address output set up time	No wait	$\frac{1 \times 10^9}{2 \cdot f(f_2)} - 35$		ns
		Wait 1	$\frac{2 \times 10^9}{2 \cdot f(f_2)} - 35$		ns
th(ALE–A)	Address hold time	No wait	9		ns
		Wait 1	$\frac{1 \times 10^9}{2 \cdot f(f_2)} - 25$		ns
td(ALE–WE) td(ALE–RDE)	ALE output delay time	No wait	4		ns
		Wait 1	$\frac{1 \times 10^9}{2 \cdot f(f_2)} - 30$		ns
td(WE–DQ)	Data output delay time			45	ns
th(WE–DQ)	Data hold time		$\frac{1 \times 10^9}{2 \cdot f(f_2)} - 22$		ns
tw(WE)	$\overline{WEL}/\overline{WEH}$ pulse width	No wait	$\frac{2 \times 10^9}{2 \cdot f(f_2)} - 30$		ns
		Wait 1	$\frac{4 \times 10^9}{2 \cdot f(f_2)} - 30$		ns
tpxz(RDE–DZ)	Floating start delay time			5	ns
tpzx(RDE–DZ)	Floating release delay time		$\frac{1 \times 10^9}{2 \cdot f(f_2)} - 20$		ns
tw(RDE)	\overline{RDE} pulse width	No wait	$\frac{2 \times 10^9}{2 \cdot f(f_2)} - 32$		ns
		Wait 1	$\frac{4 \times 10^9}{2 \cdot f(f_2)} - 32$		ns
td(RSMP–WE) td(RSMP–RDE)	RSMP output delay time		$\frac{1 \times 10^9}{2 \cdot f(f_2)} - 30$		ns
th(ϕ_1 –RSMP)	RSMP hold time		0		ns
td(WE– ϕ_1) td(RDE– ϕ_1)	ϕ_1 output delay time		0	18	ns

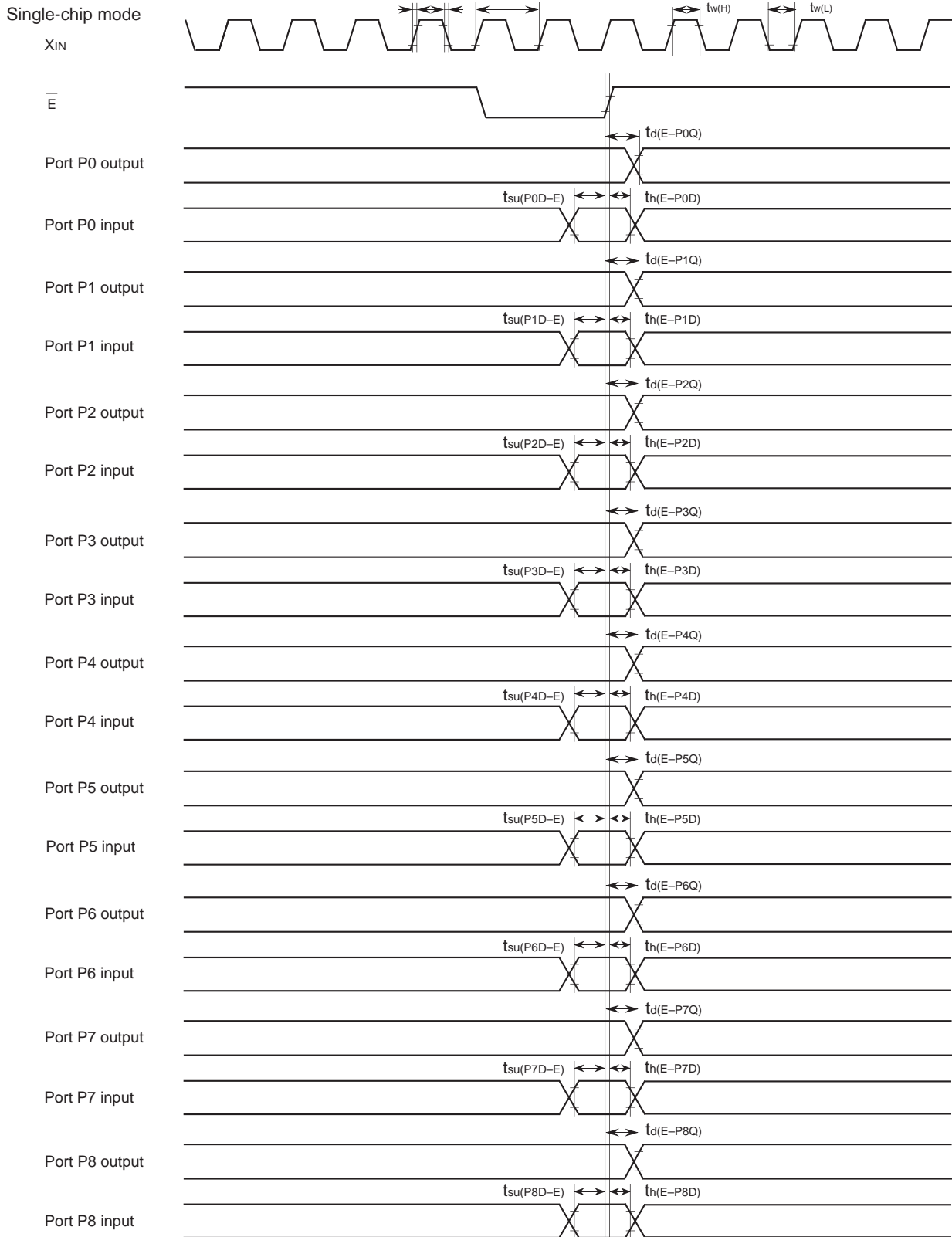
Notes 1. This applies when the main-clock division selection bit = "0".

2. $f(f_2)$ represents the clock f_2 frequency.

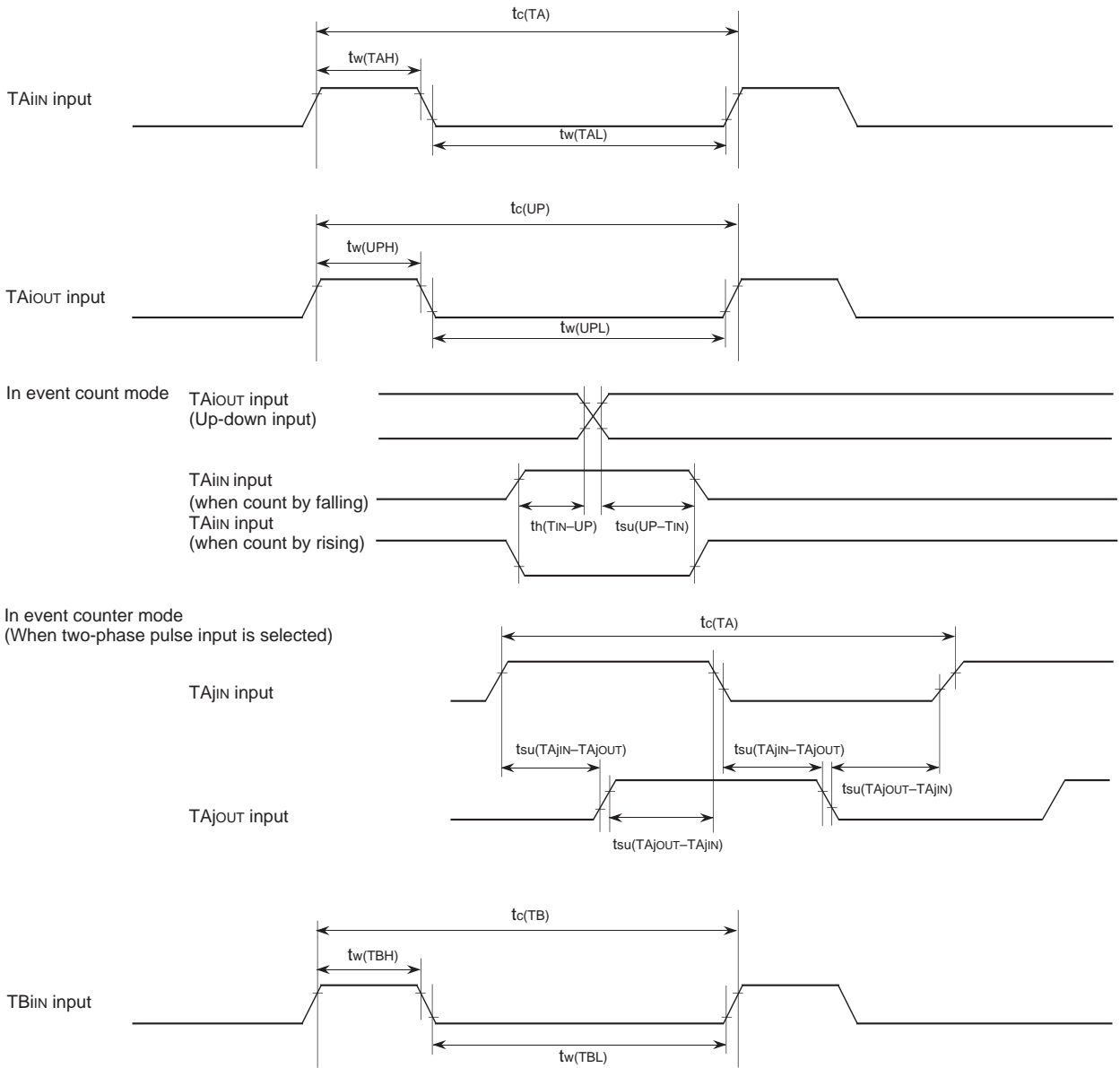
For the relation to the main clock and sub clock, refer to Table 10 in data sheet "M37735MHBXXXFP".

PRELIMINARY
 Notice: This is not a final specification.
 Some parametric limits are subject to change.

TIMING DIAGRAM



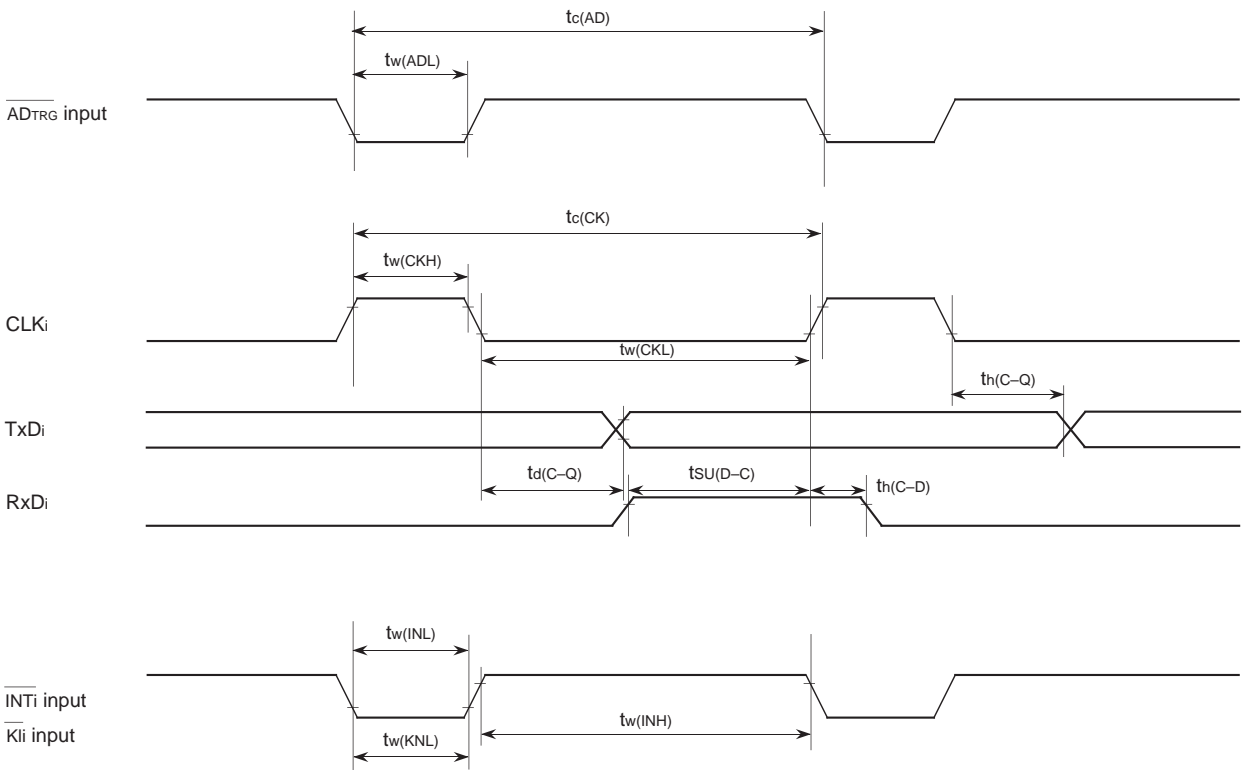
PRELIMINARY
 Notice: This is not a final specification.
 Some parametric limits are subject to change.



PRELIMINARY
 Notice: This is not a final specification.
 Some parametric limits are subject to change.

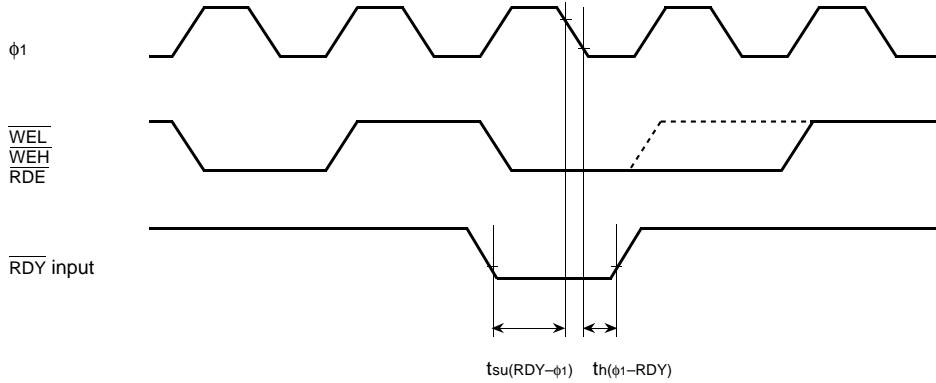
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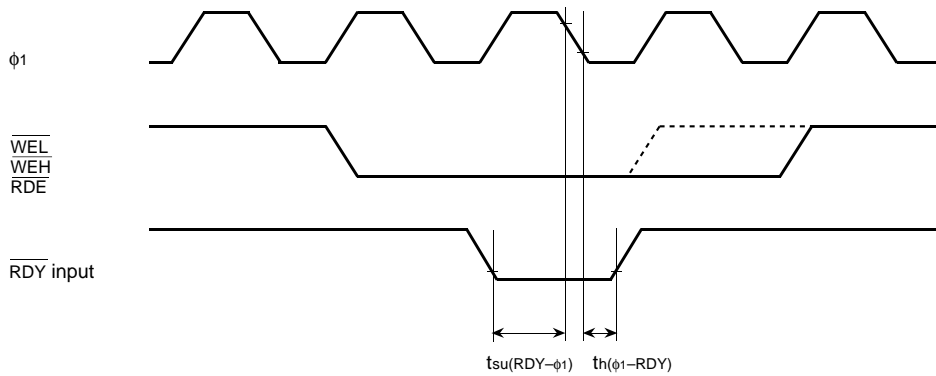


PRELIMINARY
 Notice: This is not a final specification.
 Some parametric limits are subject to change.

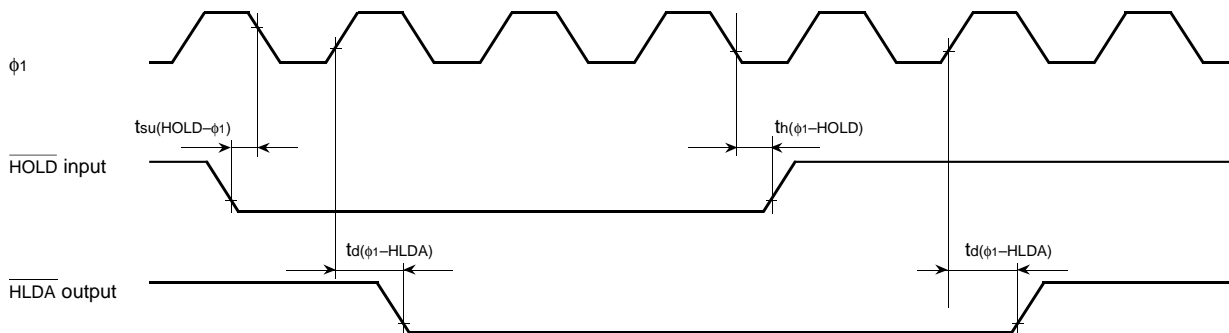
Memory expansion mode and microprocessor mode
 (When wait bit = "1")



(When wait bit = "0")



(When wait bit = "1" or "0" in common)



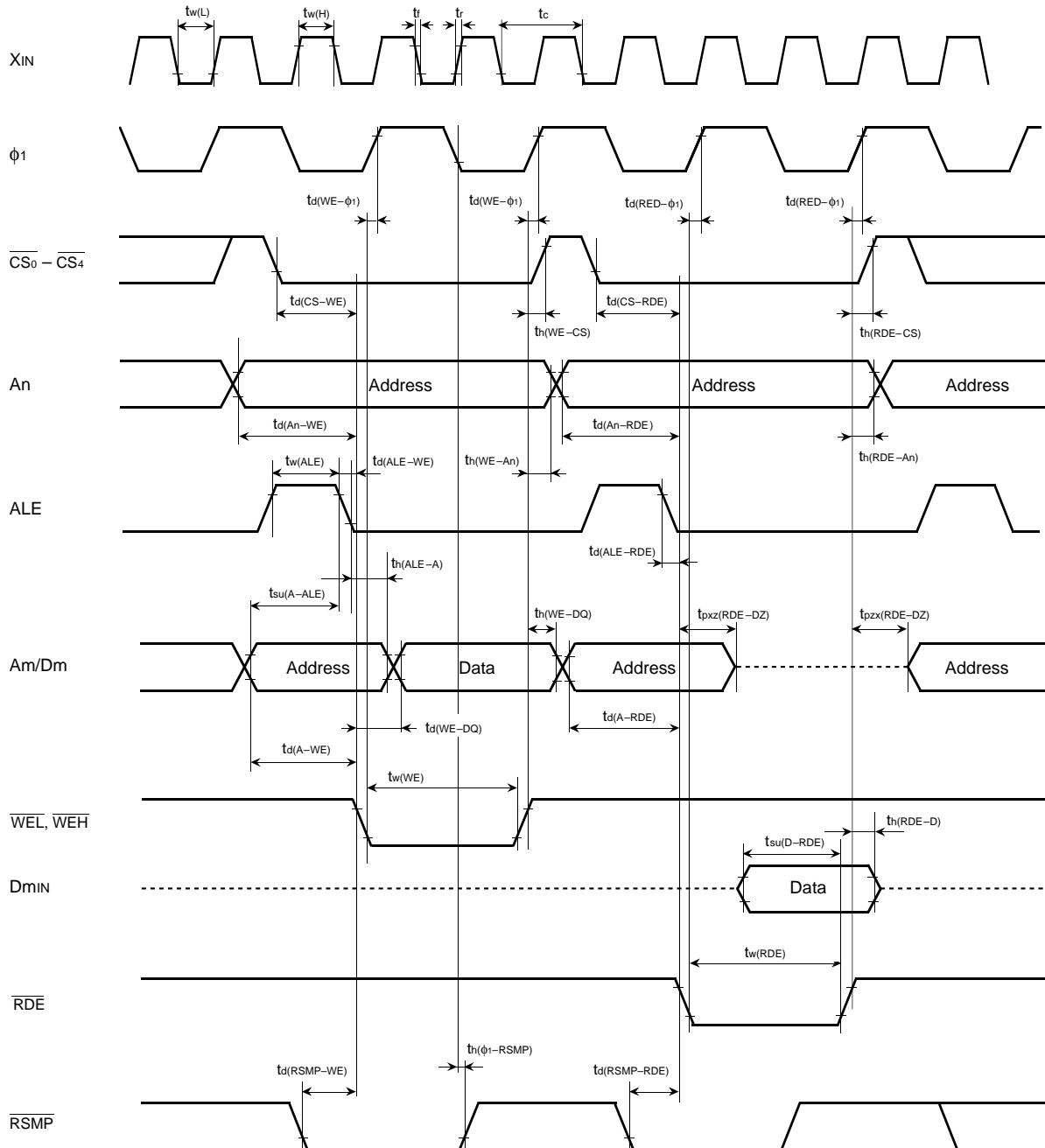
- Test conditions
- $V_{CC} = 5\text{ V} \pm 10\%$
 - Input timing voltage : $V_{IL} = 1.0\text{ V}$, $V_{IH} = 4.0\text{ V}$
 - Output timing voltage : $V_{OL} = 0.8\text{ V}$, $V_{OH} = 2.0\text{ V}$

PRELIMINARY
 Notice: This is not a final specification.
 Some parametric limits are subject to change.

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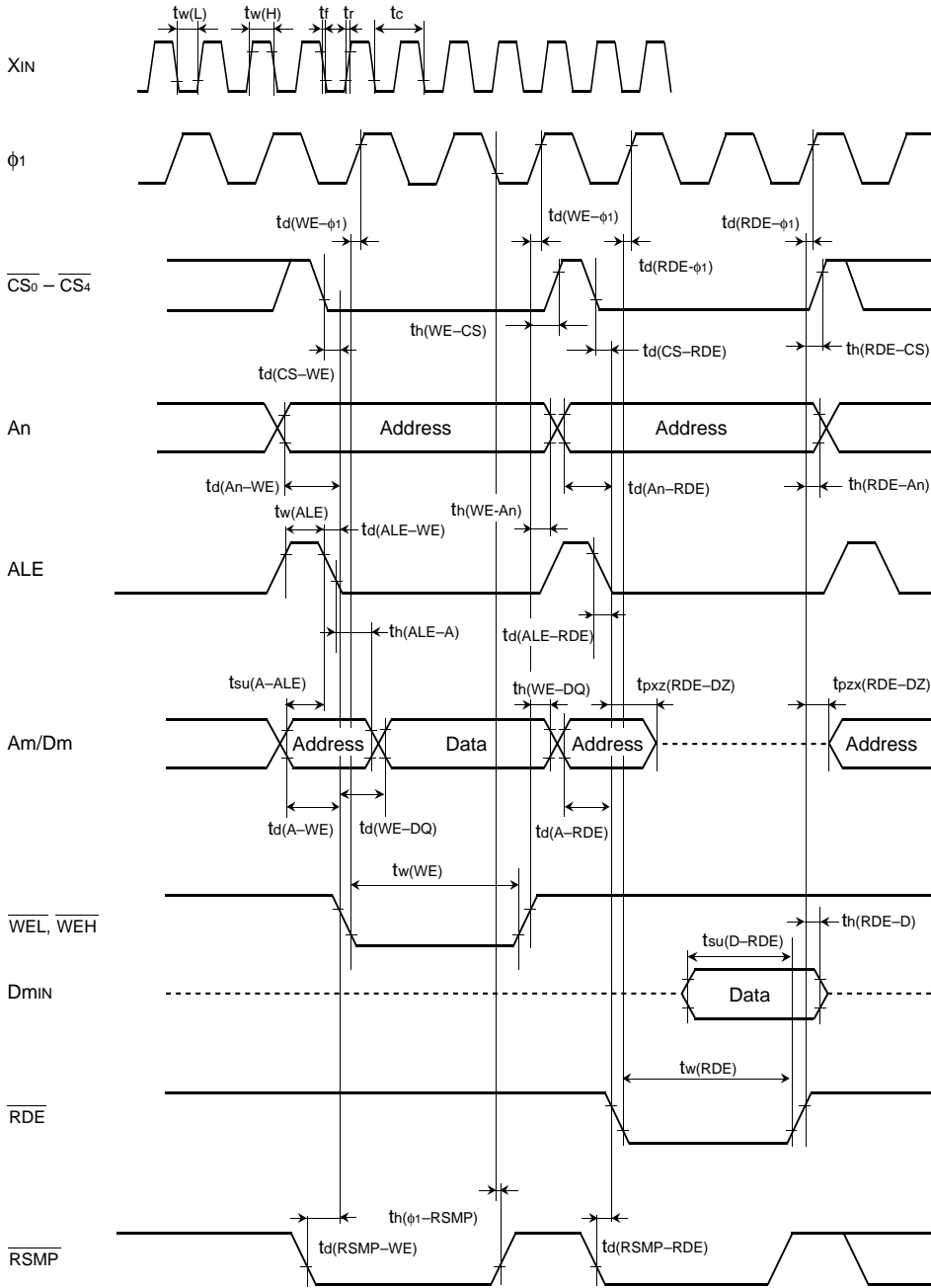
Memory expansion mode and microprocessor mode
 (No wait : When wait bit = "1")



- Test condition
- $V_{CC} = 5\text{ V} \pm 10\%$
 - Output timing voltage : $V_{IL} = 0.8\text{ V}$, $V_{IH} = 2.0\text{ V}$
 - Data input D_{MIN} : $V_{IL} = 0.8\text{ V}$, $V_{IH} = 2.5\text{ V}$

PRELIMINARY
 Notice: This is not a final specification.
 Some parametric limits are subject to change.

Memory expansion mode and microprocessor mode
 (Wait 1 : The external area is accessed when wait bit = "0" and wait selection bit = "1".)



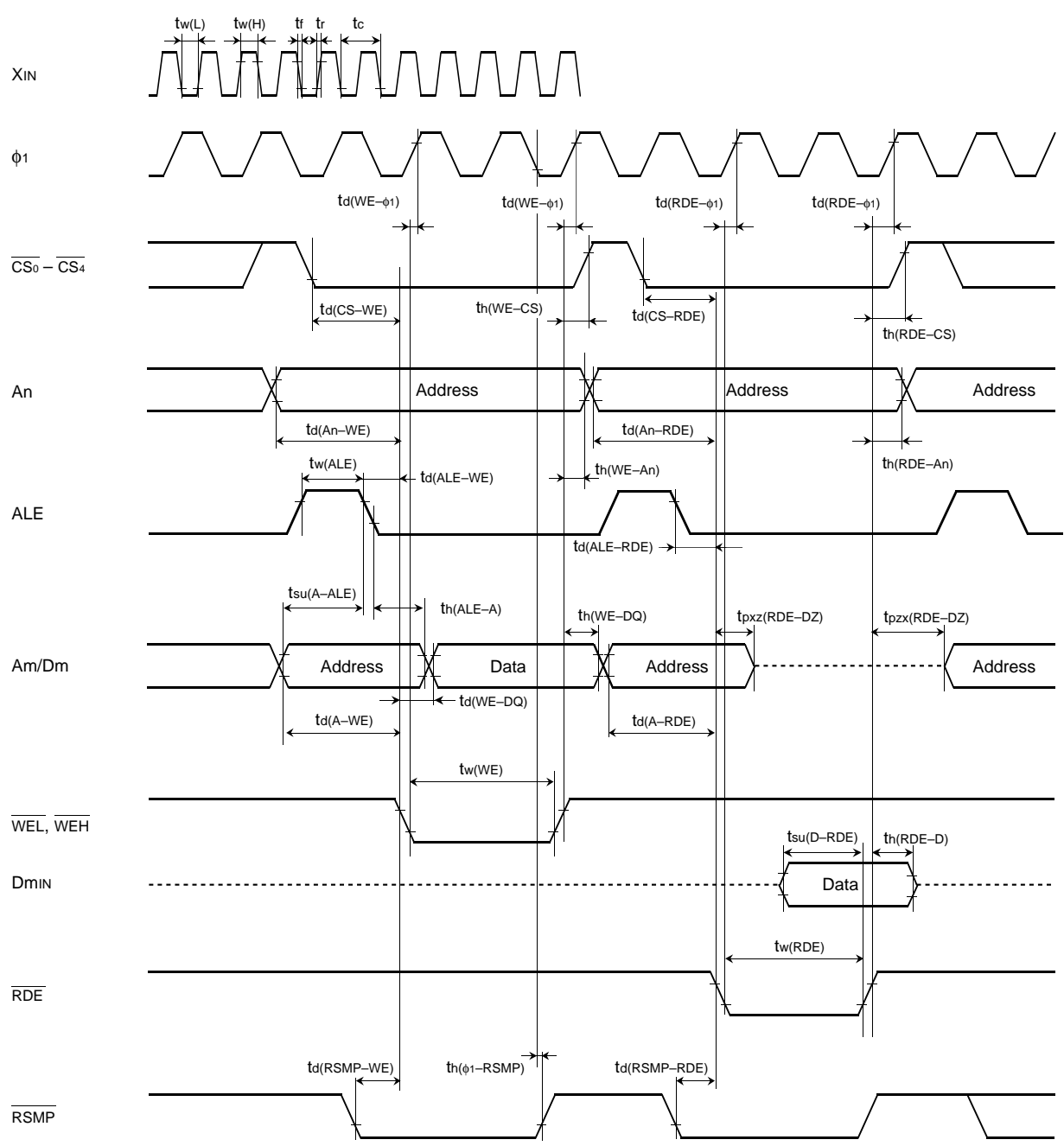
- Test condition
- $V_{CC} = 5\text{ V} \pm 10\%$
 - Output timing voltage : $V_{OL} = 0.8\text{ V}$, $V_{OH} = 2.0\text{ V}$
 - Data input Dmin : $V_{IL} = 0.8\text{ V}$, $V_{IH} = 2.5\text{ V}$

PRELIMINARY
 Notice: This is not a final specification.
 Some parametric limits are subject to change.

MITSUBISHI MICROCOMPUTERS
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SINGLE-CHIP 16-BIT CMOS MICROCOMPUTER

Memory expansion mode and microprocessor mode
 (Wait 0 : The external memory area is accessed when wait bit = "0" and wait selection bit = "0".)



- Test conditions
- Vcc = 5 V ± 10%
 - Output timing voltage : VOL = 0.8 V, VOH = 2.0 V
 - Data input Dmin : VIL = 0.8 V, VIH = 2.5 V

PRELIMINARY
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PACKAGE OUTLINE

80P6N-A **Plastic 80pin 14x20mm body QFP**

EIAJ Package Code	JEDEC Code	Weight (g)	Lead Material
QFP80-P-1420-0.80	-	1.58	Alloy 42

Scale :

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	-	-	3.05
A1	0	0.1	0.2
A2	-	2.8	-
b	0.3	0.35	0.45
c	0.13	0.15	0.2
D	13.8	14.0	14.2
E	19.8	20.0	20.2
e	-	0.8	-
Hd	16.5	16.8	17.1
HE	22.5	22.8	23.1
L	0.4	0.6	0.8
L1	-	1.4	-
y	-	-	0.1
theta	0°	-	10°
b2	-	0.5	-
l2	1.3	-	-
MD	-	14.6	-
ME	-	20.6	-

**7700 FAMILY MASK ROM ORDER CONFIRMATION FORM
SINGLE-CHIP 16-BIT MICROCOMPUTER
M37735M4BXXXXFP
MITSUBISHI ELECTRIC**

Mask ROM number	
-----------------	--

Receipt	Date:	
	Section head signature	Supervisor signature

Note : Please fill in all items marked ※

※ Customer	Company name	TEL ()	Issuance signatures	Responsible officer	Supervisor
	Date issued	Date:			

※ 1. Confirmation

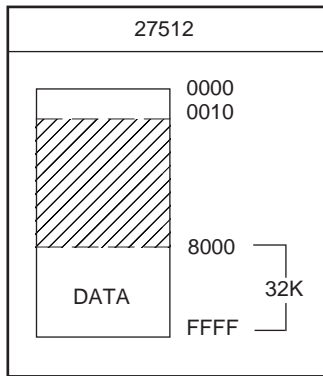
Specify the name of the product being ordered.
 Three sets of EPROMs are required for each pattern (Check @ in the appropriate box).
 If at least two of the three sets of EPROMs submitted contain the identical data, we will produce masks based on this data.
 We shall assume the responsibility for errors only if the mask ROM data on the products we produce differ from this data.
 Thus, the customer must be especially careful in verifying the data contained in the EPROMs submitted.

Checksum code for entire EPROM areas

--	--	--	--

 (hexadecimal notation)

EPROM Type :



- (1) Set "FF₁₆" in the shaded area.
- (2) Address 0₁₆ to 10₁₆ are the area for storing the data on model designation and options. This area must be written with the data shown below.
 Details for option data are given next in the section describing the STP instruction option.
 Address and data are written in hexadecimal notation.

Address	Address	Address
4D	0	42
33	1	FF
37	2	FF
37	3	FF
33	4	FF
35	5	FF
4D	6	FF
34	7	FF
	8	Option data
	9	
	A	
	B	
	C	
	D	
	E	
	F	
	10	

※2. STP instruction option

One of the following sets of data should be written to the option data address (10₁₆) of the EPROM you have ordered.
 Check @ in the appropriate box.

- STP instruction enable

01 ₁₆

 Address 10₁₆
- STP instruction disable

00 ₁₆

 Address 10₁₆

※3. Mark specification

Mark specification must be submitted using the correct form for the type of package being ordered fill out the appropriate 80P6N Mark Specification Form (for M37735M4BXXXXFP) and attach to the Mask ROM Order Confirmation Form.

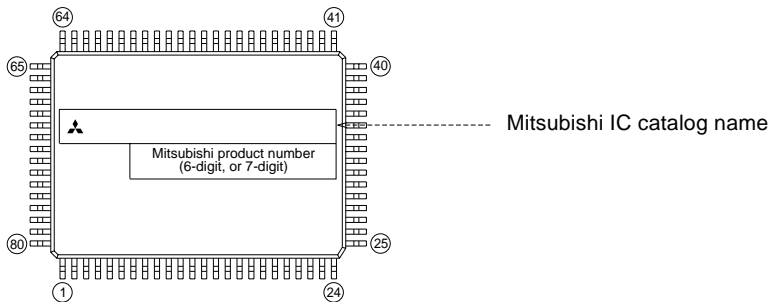
※4. Comments

80P6N (80-PIN QFP) MARK SPECIFICATION FORM

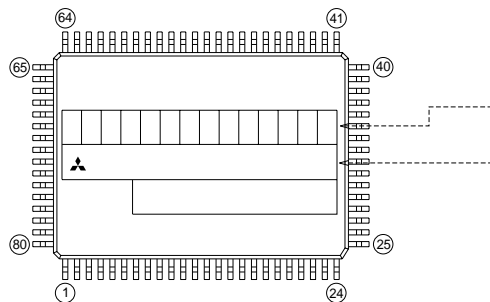
Mitsubishi IC catalog name

Please choose one of the marking types below (A, B, C), and enter the Mitsubishi IC catalog name and the special mark (if needed).

A. Standard Mitsubishi Mark



B. Customer's Parts Number + Mitsubishi IC Catalog Name



Customer's Parts Number

Note : The fonts and size of characters are standard Mitsubishi type.

Mitsubishi IC catalog name

Notes 1 : The mark field should be written right aligned.

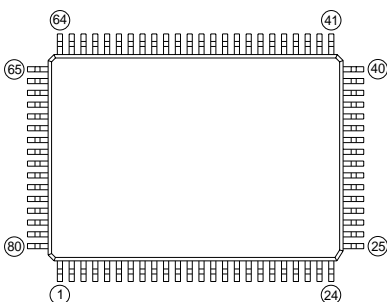
2 : The fonts and size of characters are standard Mitsubishi type.

3 : Customer's parts number can be up to 14 alphanumeric characters for capital letters, hyphens, commas, periods and so on.

4 : If the Mitsubishi logo is not required, check the box below.

Mitsubishi logo is not required

C. Special Mark Required



Notes1 : If special mark is to be printed, indicate the desired layout of the mark in the left figure. The layout will be duplicated technically as close as possible.

Mitsubishi product number (6-digit, or 7-digit) and Mask ROM number (3-digit) are always marked for sorting the products.

2 : If special character fonts (e.g., customer's trade mark logo) must be used in Special Mark, check the box below.

For the new special character fonts, a clean font original (ideally logo drawing) must be submitted.

Special character fonts required

PRELIMINARY
Notice: This is not a final specification.
Some parametric limits are subject to change.

MITSUBISHI MICROCOMPUTERS
M37735M4BXXXFP

SINGLE-CHIP 16-BIT CMOS MICROCOMPUTER

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REVISION DESCRIPTION LIST

M37735M4BXXXFP DATA SHEET

Rev. No.	Revision Description	Rev. date
1.0	First Edition	970604
1.01	The following are added: <ul style="list-style-type: none">•MASK ROM ORDER CONFIRMATION FORM•MARK SPECIFICATION FORM	980526