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Renesas Electronics Corporation

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M16C/64 Group

Operation of Timer A (timer mode, gate function)

1. Abstract

In timer mode, choose functions from those listed in Table 1. Operations of the circled items are described below.

2. Introduction

This application note is applied to the M16C/64 group microcomputers.

This program can be operated under the condition of M16C family products with the same SFR (Special Function Register) as M16C/64 Group products. Because some functions may be modified of the M16C family products, see the user's manual. When using the functions shown in this application note, evaluate them carefully for an operation.

3. Chosen functions

Table 1. Chosen functions

Item	Set-up	
Count source	<input type="radio"/>	Internal count source (f1TIMAB/f2TIMAB/f8TIMAB/f32TIMAB/f64TIMAB/foco-s/fc32)
Pulse output function	<input type="radio"/>	No pulse output
	<input type="checkbox"/>	Pulses output
Gate function	<input type="checkbox"/>	No gate function
	<input type="checkbox"/>	Performs count only for the period in which the TAIiN pin is at "L" level
	<input type="radio"/>	Performs count only for the period in which the TAIiN pin is at "H" level
Output polar control	<input type="radio"/>	Output waveform "H" active
	<input type="checkbox"/>	Output waveform "L" active (output reversed)

Note: i=0~4

4. Operation

- (1) When the count start flag is set to "1" and the TAIiN pin inputs at "H" level, the counter performs a down count on the count source.
- (2) When the TAIiN pin inputs at "L" level, the counter stops and holds its value.
- (3) If an underflow occurs, the content of the reload register is reloaded to the counter, and the count continues. At this time, the timer Ai interrupt request bit goes to "1".
- (4) Setting the count start flag to "0" causes the counter to stop and to hold its value.

Note: ▪ Make the pulse width of the signal input to the TAIiN pin not less than two cycles of the count source.
Figure 1 shows the operation timing.

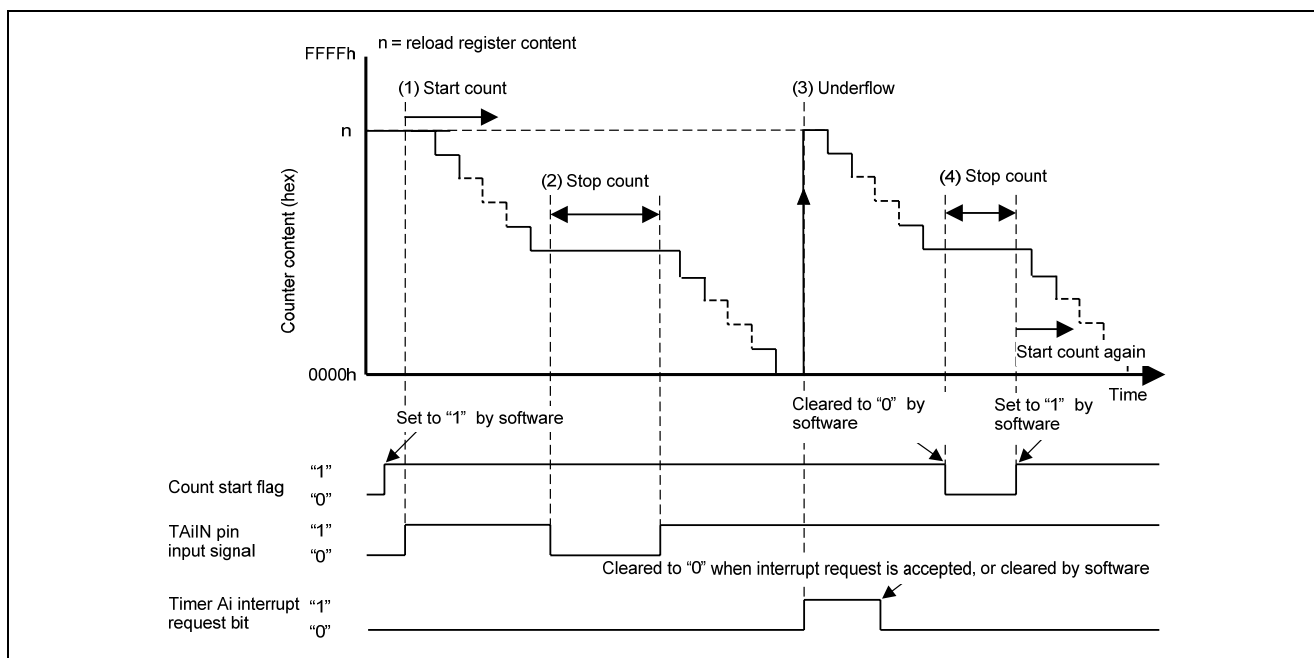


Figure 1. Operation timing of timer mode, gate function selected

5. Set-up procedure

Table 2 shows Timer A count source, Figure 2 shows block diagram of Timer A count source in timer mode.

Table 2. Count Source Selection of Timer A

TACSj register (Note 1)				TAiMR register		Count source	Count source period
TCS3/ TCS7	TCS2/ TCS6	TCS1/ TCS5	TCS0/ TCS4	TCK1	TCK0		f(PLL):24MHz f(XcIN):32.768kHz
0	-	-	-	0	0	f1TIMAB/f2TIMAB (Note 2)	41.7ns or 83.3ns
0	-	-	-	0	1	f8TIMAB	333.3ns
0	-	-	-	1	0	f32TIMAB	1333.3ns
0	-	-	-	1	1	fc32	976.56μs
1	0	0	0	-	-	f1TIMAB/f2TIMAB (Note 2)	41.7ns or 83.3ns
1	0	0	1	-	-	f8TIMAB	333.3ns
1	0	1	0	-	-	f32TIMAB	1333.3ns
1	0	1	1	-	-	f64TIMAB	2666.7ns
1	1	0	1	-	-	foco-s	About 8μs
1	1	1	0	-	-	fc32	976.56μs

Note 1: TCS3~TCS0 bits of TACS0 register correspond to Timer A0 count source selection, TCS7~TCS4 bits of TACS0 register correspond to Timer A1 count source selection, TCS3~TCS0 bits of TACS1 register correspond to Timer A2 count source selection, TCS7~TCS4 bits of TACS1 register correspond to Timer A3 count source selection, and TCS3~TCS0 bits of TACS2 register correspond to Timer A4 count source selection.
 Note 2: When the PCLK0 bit in the PCLKR register is "1", the selected clock source is f1TIMAB. When the PCLK0 bit is "0", the selected clock source is f2TIMAB.

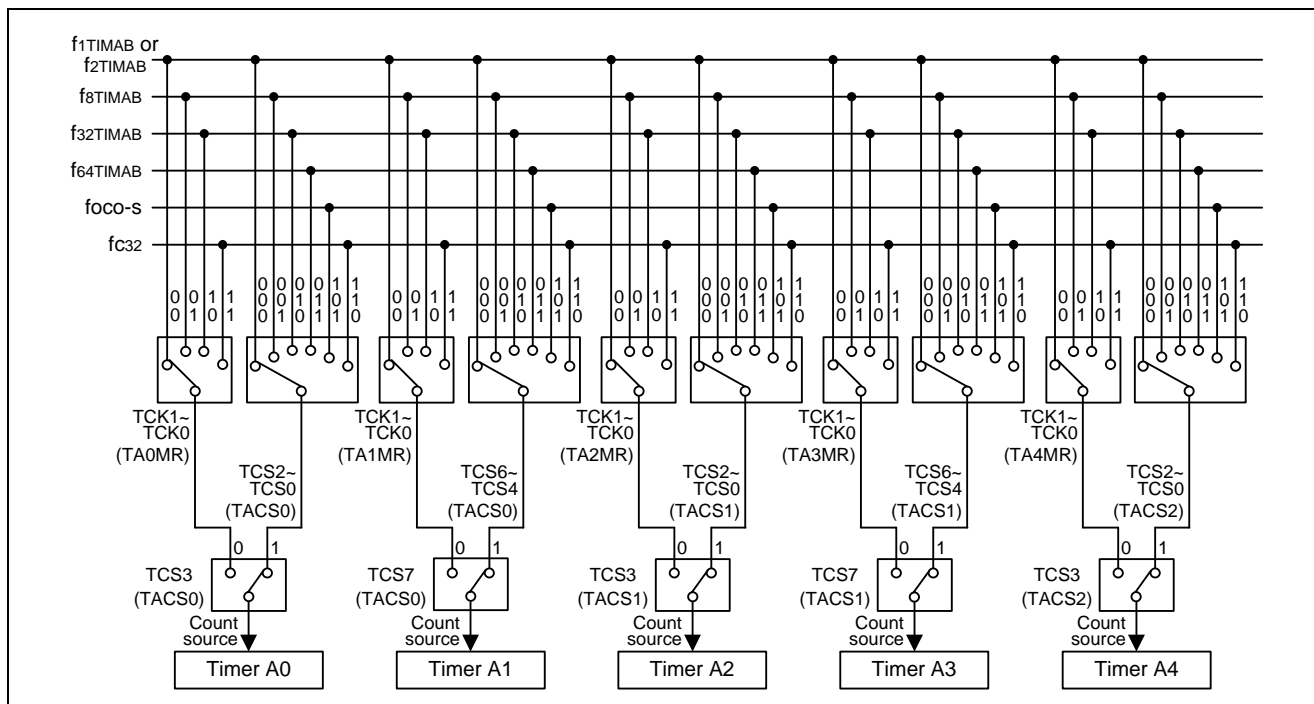
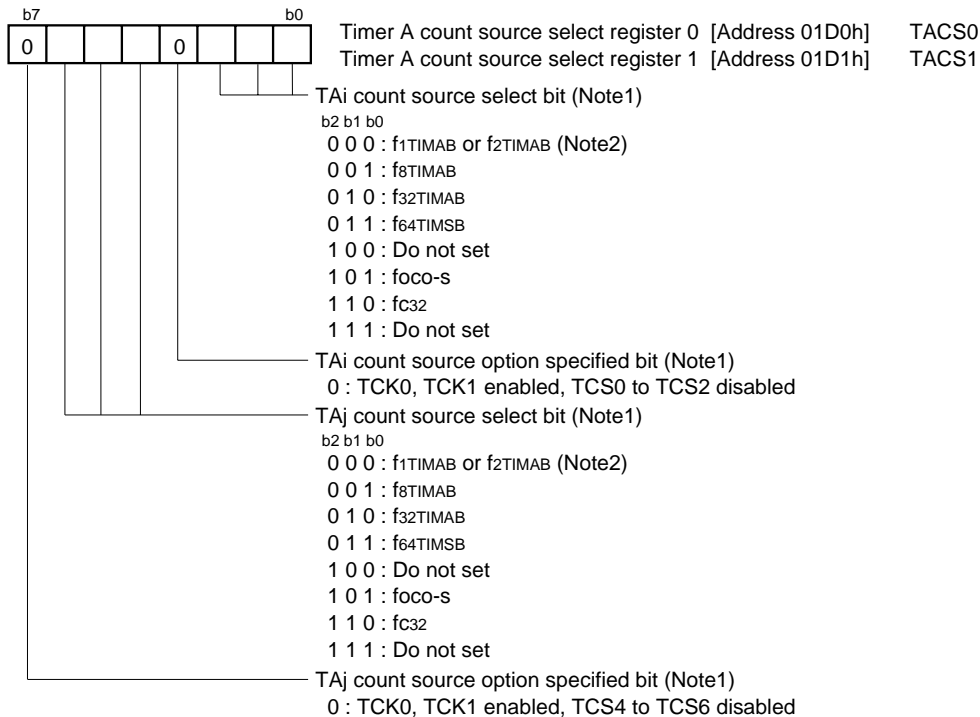


Figure 2. Count source of Timer A

Selecting timer count source

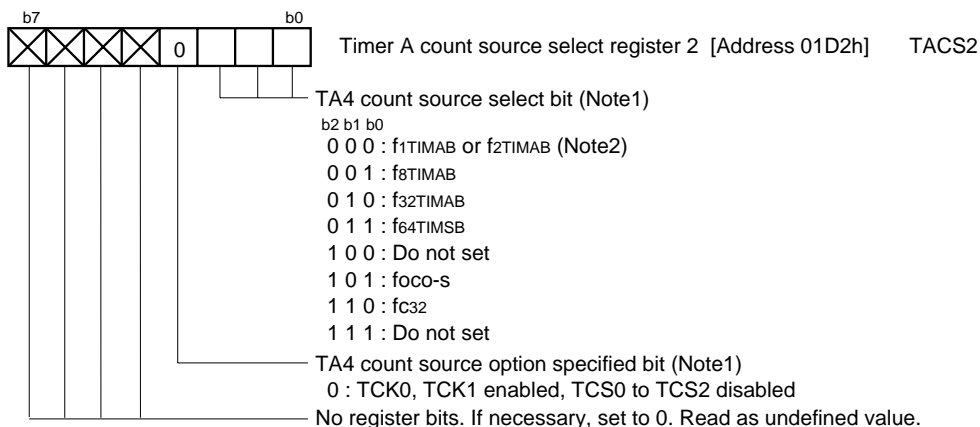
TACS0 register can select Timer A0 and Timer A1 count source, TACS1 can select Timer A2 and Timer A3 count source, and TACS2 can select Timer A4 count source.



TACS0 register: i = 0, j = 1, TACS1 register: i = 2, j = 3

Note 1: About the count source period, please refer to Table 2.

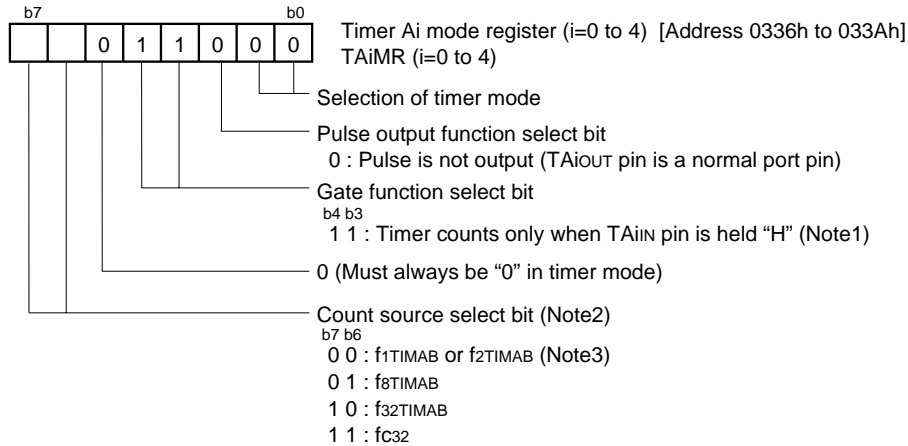
Note 2: When the PCLK0 bit in the PCLKR register is "1", the selected clock source is f1TIMAB. When the PCLK0 bit is "0", the selected clock source is f2TIMAB.



Note 1: About the count source period, please refer to Table 2.

Note 2: When the PCLK0 bit in the PCLKR register is "1", the selected clock source is f1TIMAB. When the PCLK0 bit is "0", the selected clock source is f2TIMAB.

Selecting timer mode and functions

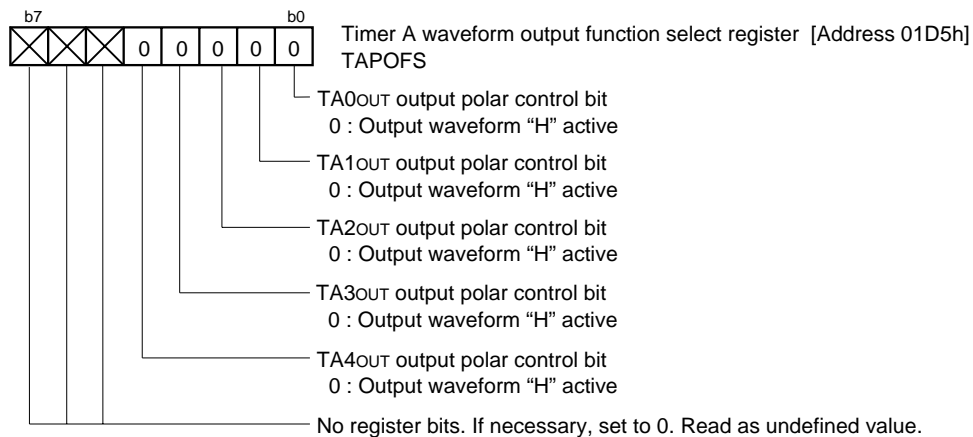


Note 1: Set the corresponding port direction register to "0".

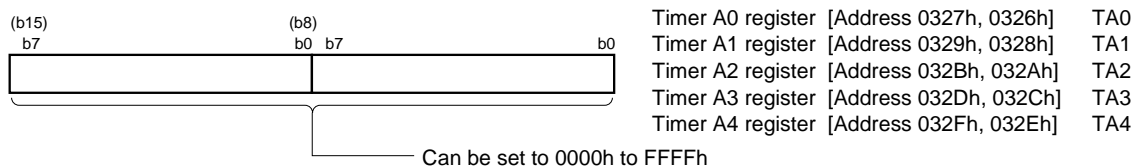
Note 2: Valid when the TCS3 bit or TCS7 bit in registers TACS0 to TACS2 is set to 0 (TCK0, TCK1 enabled). About the count source period, please refer to Table 2.

Note 3: When the PCLK0 bit in the PCLKR register is "1", the selected clock source is f1TIMAB. When the PCLK0 bit is "0", the selected clock source is f2TIMAB.

Selecting waveform output function

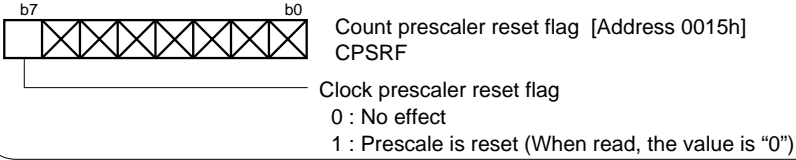


Setting counter value

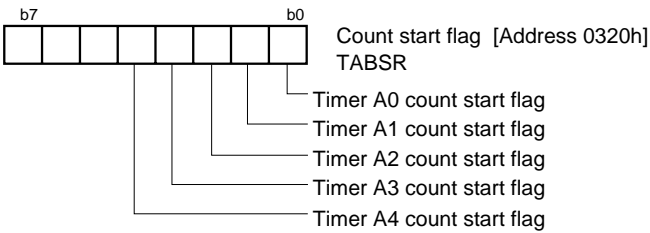


Setting clock prescaler reset flag

(This function is effective when fc32 is selected as the count source. Reset the prescaler for generating fc32 by dividing the X_{CIN} by 32.)



Setting count start flag



Start count

6. Reference

Hardware manual

M16C/64 Group Hardware Manual

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Revision

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