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M16C/65 Group

Operation of Timer A (2-phase pulse signal process in event counter mode, normal processing operation)

1. Abstract

In processing 2-phase pulse signals in event counter mode, choose functions from those listed in Table 1. Operations of the circled items are described below. Figure 1 shows the operation timing. A reference program is an example when using the Timer A2 interrupt based on the setting procedure in this application note.

2. Introduction

This application note is applied to the M16C/65 group microcomputers.

This application note can be used with other M16C Family MCUs which have the same special function registers (SFRs) as the above group. Check the manual for any modifications to functions. Careful evaluation is recommended before using the program described in this application note.

3. Chosen functions

Table 1. Chosen functions

Item	Set-up	
Count operation type		Reload type
	O	Free-run type
2-phase pulses process (Note)	O	Normal processing
		Multiply-by-4 processing
Output polar control	O	Output waveform “H” active
		Output waveform “L” active (output reversed)

Note: Timer A3 alone can be selected. Timer A2 is solely used for normal processing, and timer A4 is solely used for 4 multiplication processing.

4. Operation

(1) Setting the count start flag to “1” causes the counter to count the effective edges of the count source.

(2) Even if an underflow occurs, the content of the reload register is not reloaded to the counter, but the count continues. At this time, the timer Ai interrupt request bit goes to “1”.

(3) Even if an overflow occurs, the content of the reload register is not reloaded to the counter, but the count continues. At this time, the timer Ai interrupt request bit goes to “1”.

Note:

- When the TAiOUT pin is held “H”, the edge applied to the TAiIN pin will be the effective edge.
- The up count or down count conditions are as follows:

If a rising edge is present at the TAiIN pin when the input signal level to the TAiOUT pin is “H”, an up count is performed.

If a falling edge is present at the TAiIN pin when the input signal level to the TAiOUT pin is “H”, a down count is performed.

Figure 1 shows the operation timing.

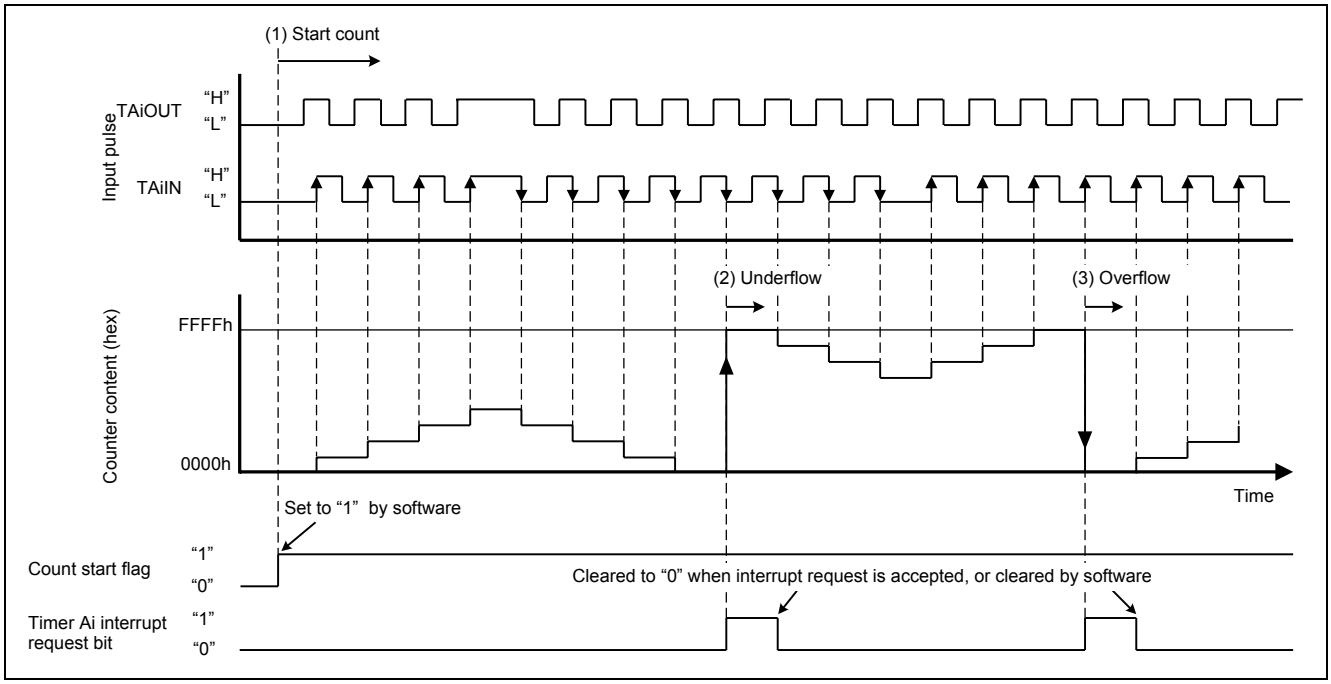
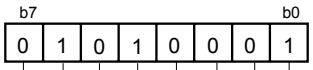


Figure 1. Operation timing of 2-phase pulse signal process in event counter mode, normal processing operation

5. Set-up procedure

Selecting event counter mode and functions



Timer Ai mode register (i=2, 3) [Address 0338h to 0339h]
TAiMR (i=2, 3)

Selection of event counter mode

0 (Must always be “0” when using two-phase pulse signal processing)

0 (Must always be “0” when using two-phase pulse signal processing)

1 (Must always be “1” when using two-phase pulse signal processing)

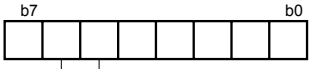
0 (Must always be “0” when using two-phase pulse signal processing)

Count operation type select bit
1 : Free-run type

Two-phase pulse signal processing operation select bit (Note 1)
0 : Normal processing operation

Note 1: This bit is valid for timer A3 mode register. For timer A2 mode register, this bit can be “0” or “1”.

Setting two-phase pulse signal processing select bit



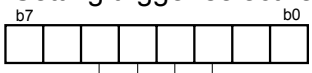
Up/down flag UDF [Address 0324h]

Timer A2 two-phase pulse signal processing select bit (Note 2)
1 : Two-phase pulse signal processing enabled

Timer A3 two-phase pulse signal processing select bit (Note 2)
1 : Two-phase pulse signal processing enabled

Note 2: Set the TAiIN,TAiOUT corresponding port direction register to “0”.

Setting trigger select register



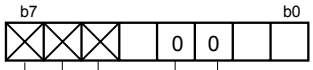
Trigger select register TRGSR [Address 0323h]

Timer A2 event/trigger select bit
b3 b2
0 0 : Input on TA2IN is selected (Note 3)

Timer A3 event/trigger select bit
b5 b4
0 0 : Input on TA3IN is selected (Note 3)

Note 3: Set the corresponding port direction register to “0”.

Selecting waveform output function

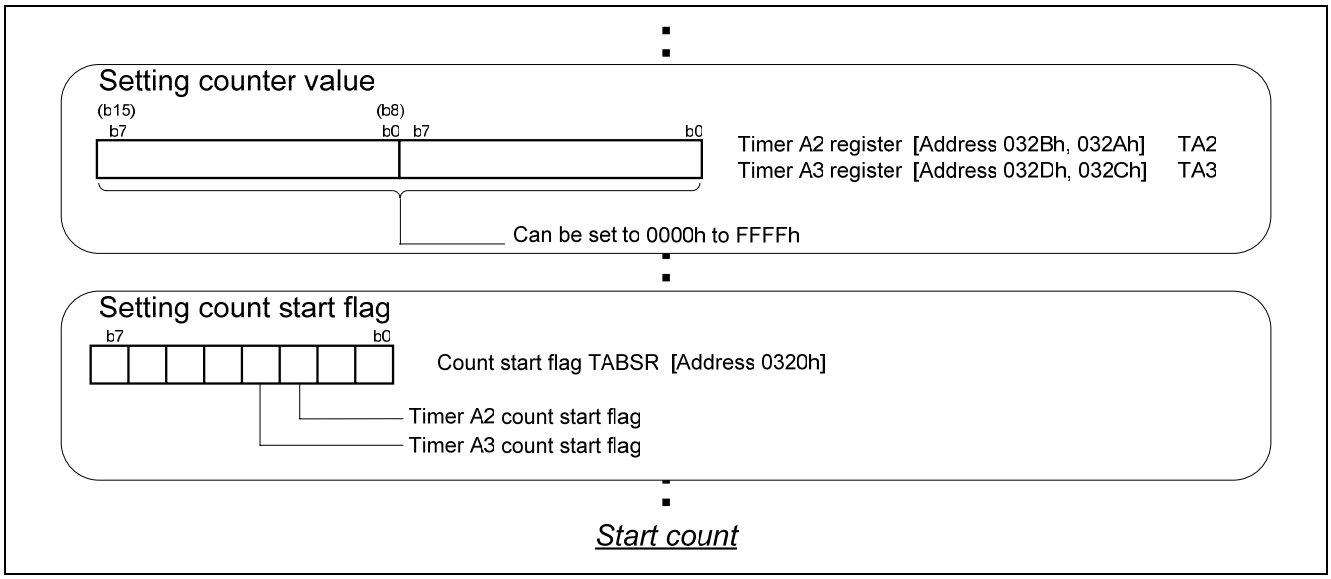


Timer A waveform output function select register [Address 01D5h]
TAPOFS

TA2OUT output polar control bit
0 : Output waveform “H” active

TA3OUT output polar control bit
0 : Output waveform “H” active

No register bits. If necessary, set to 0. Read as undefined value.


Setting counter value
(b15)
(b8)
b7
b0
b7
b0
Timer A2 register [Address 032Bh, 032Ah] TA2
Timer A3 register [Address 032Dh, 032Ch] TA3
Can be set to 0000h to FFFFh
Setting count start flag
b7
b0
Count start flag TABSR [Address 0320h]
Timer A2 count start flag
Timer A3 count start flag
Start count

6. Reference

Hardware manual

M16C/65 Group Hardware Manual

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