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R32C/100 Series

Timer B Operation in Pulse-period Measurement Mode

1. Abstract

The functions listed in **Table 3.1** can be selected in pulse-period measurement mode or pulse-width measurement mode. The operation with the functions denoted with an “O” in **Table 3.1** is described in this document. The operation timing is shown in **Figure 4.1**, and the setting procedure is described in chapter **5. “Setting”**. The reference program is based on the settings found in chapter **5. “Setting”**. The example assumes a timer B0 interrupt is used.

2. Introduction

The application described in this document applies to the following MCU:

- MCU: R32C/118 Group

This program can be used with other R32C/100 Series MCUs which have the same special function registers (SFRs) as the R32C/118 Group. Check the manual for any additions or modifications to functions. Careful evaluation is recommended before using this application note.

3. Functions

Table 3.1 Functions Described in This Document

Function	Description	
Count source	O	Internal count source: f1, f8, f2n, or fC32
Measurement mode	O	Pulse-period measurement when pulse is between falling edges
		Pulse-period measurement when pulse is between rising edges
		Pulse-width measurement when pulse is either between a falling edge and a rising edge, or between a rising edge and a falling edge

4. Operation

(1) After setting the count start flag to 1, the counter starts counting the count source.
(2) When the pulse to be measured changes from high to low, the counter value becomes 0000h, and measurement starts. At this point, the reload register transfers an undefined value. A timer Bi interrupt request (i = 0 to 5) is not generated.
(3) When the measured pulse again changes from high to low, the counter value is transferred to the reload register, and the timer Bi interrupt request flag becomes 1. Then, the counter value becomes 0000h and measurement starts again.

Supplemental Information

- The timer Bi interrupt request flag becomes 1 when the active edge of the measured pulse is input, or when timer Bi overflows. The interrupt request source can be determined with the timer Bi overflow flag in the interrupt routine.
- The counter value is undefined when the count starts. Therefore, after the count starts, the timer Bi overflow flag may become 1 before the active edge is input, and a timer Bi interrupt request may be generated.
- After reset, the timer Bi overflow flag is undefined. The timer Bi overflow flag becomes 0 when writing to the timer Bi mode register while the count start flag is 0. The timer Bi overflow flag cannot be set to 1 by the user.
- Set the TBiIN pin that corresponds to the function select register to 00h (I/O port), and set the direction register to 0 (input port).

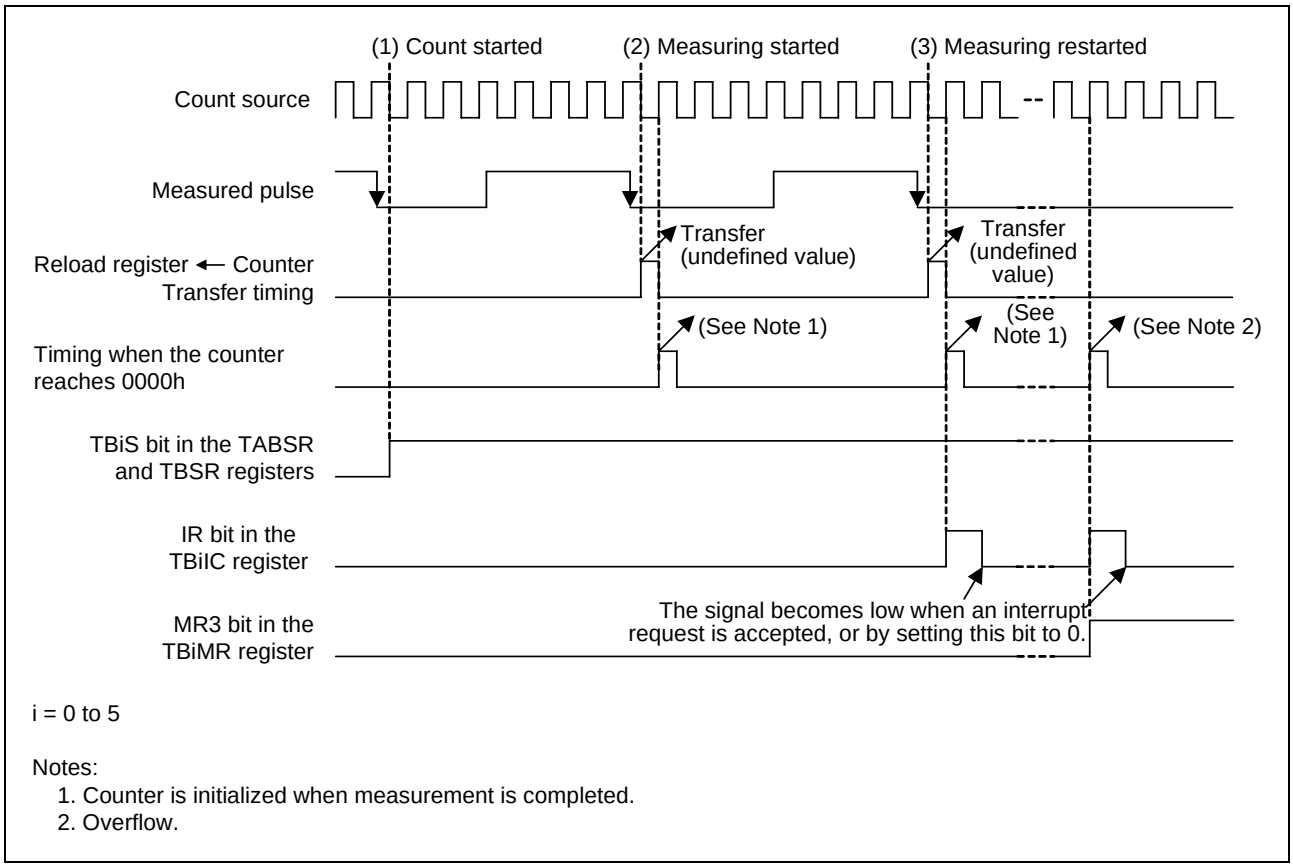
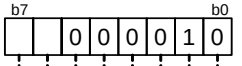


Figure 4.1 Operation Timing Diagram in Pulse-period Measurement Mode

5. Setting

(1) Set the timer Bi register (i = 0 to 5).



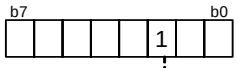
Timer Bi Mode Register (TBiMR)

- TMOD1 to TMOD0 — Operation Mode Select Bit
  - 10b: Pulse-period/pulse-width measurement mode
- MR1 to MR0 — Measure Mode Select Bit
  - 00b: Pulse-period measurement 1 (1)
- MR2 — Set to 0.
- MR3 — Timer Bi Overflow Flag
  - 0: No overflow
  - 1: Overflow
- TCK1 to TCK0 — Count Source Select Bit
  - 00b: f1
  - 01b: f8
  - 10b: f2n
  - 11b: fC32

Note:
1. Measures between a falling edge and the next falling edge of a pulse.

(2) Set the function select register. The TBiIN pin is assigned to P6_0 (TB0IN), P6_1 (TB1IN), P6_2 (TB2IN), P9_3 (TB3IN), P9_4 (TB4IN), and P6_3 (TB5IN). Set the output function select bit in the function select register to 000b (I/O port).

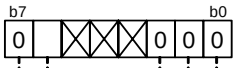
When Using P9_3 (TB3IN) and P9_4 (TB4IN)



Protect Register (PRCR)

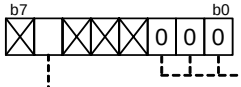
- PRC2 — Protect Bit 2 (Write Enabled for registers PLC0, PLC1, PD9, and P9_jS (j = 0 to 7))
  - 1: Write enabled

Set the PRC2 bit to 1 (write enabled). With the next instruction, rewrite the P9_jS register. Do not generate an interrupt or perform DMA transfer between setting the PRC2 bit to 1 and rewriting the P9_jS register.



Port P9_j Function Select Register (P9_jS) (j = 3, 4)

- PSEL2 to PSEL0 — Port P9_j Output Function Select Bit
  - 000b: I/O port P9_j
- NOD — N-channel Open-drain Output Select Bit
  - 0: Push-pull output
  - 1: N-channel open-drain output
- Set to 0.



Port P6_k Function Select Register (P6_kS) (k = 0 to 3)

- PSEL2 to PSEL0 — Port P6_k Output Function Select Bit
  - 000b: I/O port P6_k
- NOD — N-channel Open-drain Output Select Bit
  - 0: Push-pull output
  - 1: N-channel open-drain output

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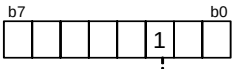
(3) Set port P6 and P9 direction registers. Set the pin to be used as the TBiIN pin (i = 0 to 5) as an input port.

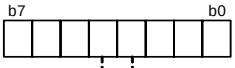
When Using P9_3 (TB3IN) and P9_4 (TB4IN)



Protect Register (PRCR)

PRC2 — Protect Bit 2 (Write Enabled for Registers PLC0, PLC1, PD9, and P9_jS (j = 0 to 7).
1: PD9 and P9_jS registers write enabled (j = 0 to 7)

Set the PRC2 bit to 1 (write enabled). With the next instruction, rewrite the P9_jS register. Do not generate an interrupt or perform DMA transfer between setting the PRC2 bit to 1 and rewriting the P9_jS register.



Port P9 Direction Register (PD9)

PD9_3 — Port P9_3 Direction Bit
0: Input port

PD9_4 — Port P9_4 Direction Bit
0: Input port

Port P6 Direction Register (PD6)

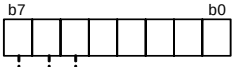
PD6_0 — Port P6_0 Direction Bit
0: Input port

PD6_1 — Port P6_1 Direction Bit
0: Input port

PD6_2 — Port P6_2 Direction Bit
0: Input port

PD6_3 — Port P6_3 Direction Bit
0: Input port

(4) Set the count start register.

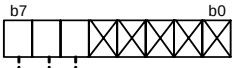


Count Start Register (TABSR)

TB0S — Timer B0 Count Start Bit
1: Count started

TB1S — Timer B1 Count Start Bit
1: Count started

TB2S — Timer B2 Count Start Bit
1: Count started



Count Start Register for Timers B3, B4, and B5 (TBSR)

TB3S — Timer B3 Count Start Bit
1: Count started

TB4S — Timer B4 Count Start Bit
1: Count started

TB5S — Timer B5 Count Start Bit
1: Count started

Count started

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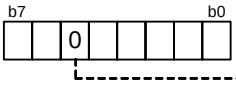
(5) Enable interrupt. Set the I flag to 1 to enable an interrupt.

(6) Clear the overflow flag.



Timer Bi Mode Register (TBiMR) (i = 0 to 5)

MR3 Timer Bi Overflow Flag
0: No overflow

6. Sample Program

A sample program can be downloaded from the Renesas Technology website.

7. Reference Documents

Hardware Manual
R32C/118 Group Hardware Manual Rev.1.00
The latest version can be downloaded from the Renesas Technology website.

Technical Update/Technical News
The latest information can be downloaded from the Renesas Technology website.

C Compiler Manual
R32C/100 Series C Compiler Package Ver. 1.02 Compiler User's Manual Rev. 1.00
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REVISION HISTORY	Timer B Operation in Pulse-period Measurement Mode

Rev.	Date	Description	
		Page	Summary
1.00	Mar. 5, 2010	—	Initial release

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