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Renesas Electronics Corporation

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1. Abstract

While timers A0 and A1 are connected, after inputting an external trigger and a specified time has elapsed, a pulse is output only once. The peripheral functions described in this document are as follows:

- Timer A0 (one-shot timer mode)
- Timer A1 (one-shot timer mode)

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. **Application Example**

3.1 **Specifications**

1. Set timer A0 to one-shot timer mode where an external input (rising edge) is used as a trigger. Set timer A1 to one-shot timer mode where timer A0 underflow is used as a trigger. Select TA1OUT output as the output function of P7_2.
2. Set 1 ms between inputting an external trigger to timer A0 and outputting a pulse. Set the timer output high level width for timer A1 to 50 μs.
3. Connect a 16 MHz oscillator to XIN. **Table 3.1** lists the setting frequencies for each clock in the sample program.

The sample program’s setting frequencies for individual clocks are shown in the following table.

<table>
<thead>
<tr>
<th>Clock</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main clock (XIN)</td>
<td>16 MHz</td>
</tr>
<tr>
<td>PLL clock</td>
<td>100 MHz</td>
</tr>
<tr>
<td>Base clock</td>
<td>50 MHz</td>
</tr>
<tr>
<td>CPU clock</td>
<td>50 MHz</td>
</tr>
<tr>
<td>Peripheral bus clock</td>
<td>25 MHz</td>
</tr>
<tr>
<td>Peripheral function clock source</td>
<td>25 MHz</td>
</tr>
</tbody>
</table>

3.2 **Operation**

1. The count for timers A0 and A1 is enabled by setting bits TA0S and TA1S in the TABSR register to 1 (count started).
2. When a falling edge is input to the TA0IN pin, the timer A0 counter decrements count source f1.
3. When the timer A0 counter value becomes 0000h, the value from the reload register is reloaded, and the count is stopped. At this time, the IR bit in the TA0IC register becomes 1 (interrupt requested).
4. When the timer A0 counter value becomes 0000h, the timer A1 counter starts counting. At the same time, TA1OUT pin output becomes high.
5. When the timer A1 counter value becomes 0000h, TA1OUT pin output becomes low, the counter reloads the value from the reload register, and the count stops. At the same time, the IR bit in the TA1IC register becomes 1 (interrupt requested).
Figure 3.1 Operation Timing for the Example Application

Figure 3.2 Timer Connections
3.3 Setting

This section shows the procedures and values to set the example in chapter 3. “Application Example”. Refer to individual MCU hardware manuals for details on individual registers.

(1) Set the timer A0 mode register.

**Timer A0 Mode Register (TA0MR)**

<table>
<thead>
<tr>
<th>b7</th>
<th>b0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

- **TMOD1 to TMOD0**: Operation Mode Select Bit
  - 10b: One-shot timer mode
- **Set to 0.**: MR1
- **External Trigger Select Bit**: 0: Falling edge of TA0IN pin input signal
- **MR2**: Trigger Select Bit
  - 1: Selected using bits TA0TGH and TA0TGL in the ONSF register
- **MR3**: Set to 0 in one-shot timer mode.
- **TCK1 to TCK0**: Count Source Select Bit
  - 00b: f1
  - 01b: f8
  - 10b: f2n
  - 11b: fC32

The peripheral function clock source is 25 MHz. If the setting value of the TA0 register is \( n \), the period of timer A0 is:

\[
\text{Period of Timer A0} = \frac{25000}{25 \times 10^6} = 10^{-3} = 1 \text{ms}
\]

Setting range: 0000h to FFFFh

(2) Set the timer A0 register.

**Timer A0 Register (TA0)**

<table>
<thead>
<tr>
<th>b15</th>
<th>b0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
</tr>
</tbody>
</table>

- Setting range: 0000h to FFFFh

(3) Set the timer A1 mode register.

**Timer A1 Mode Register (TA1MR)**

<table>
<thead>
<tr>
<th>b7</th>
<th>b0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

- **TMOD1 to TMOD0**: Operation Mode Select Bit
  - 10b: One-shot timer mode
- **Set to 0.**: MR1
- **External Trigger Select Bit**: Set to 0.
- **MR2**: Trigger Select Bit
  - 1: Selected using bits TA1TGH and TA1TGL in the TRGSR register
- **MR3**: Set to 0 in one-shot timer mode.
- **TCK1 to TCK0**: Count Source Select Bit
  - 00b: f1
  - 01b: f8
  - 10b: f2n
  - 11b: fC32

The peripheral function clock source is 25 MHz. If the setting value of the TA1 register is \( m \), the period of timer A1 is:

\[
\text{Period of Timer A1} = \frac{1250}{25 \times 10^6} = 50 \times 10^{-6} = 50 \mu\text{s}
\]

Setting range: 0000h to FFFFh

(4) Set the timer A1 register.

**Timer A1 Register (TA1)**

<table>
<thead>
<tr>
<th>b15</th>
<th>b0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
</tr>
</tbody>
</table>

- Setting range: 0000h to FFFFh

Continued on next page
(5) Set the one-shot start register and trigger select register.

<table>
<thead>
<tr>
<th>Register</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-shot Start Register (ONSF)</td>
<td>TA0TGH and TA0TGL</td>
</tr>
<tr>
<td>Trigger Select Register (TRGSR)</td>
<td>TA1TGH and TA1TGL</td>
</tr>
</tbody>
</table>

(6) Clear the interrupt request bit.

When bits TMOD1 to TMOD0 in the TA0MR and TA1MR registers are changed to 10b (one-shot timer mode), the IR bit sometimes becomes 1 (interrupt requested). Set bits TMOD1 to TMOD0 before clearing the IR bit.

(7) Set the TA1OUT output.

(8) Set the count start register.
4. **Sample Program**

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

5. **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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<table>
<thead>
<tr>
<th>REVISION HISTORY</th>
<th>Delayed One-shot Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rev.</td>
<td>Date</td>
</tr>
<tr>
<td>1.00</td>
<td>Mar. 5, 2010</td>
</tr>
</tbody>
</table>

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