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Renesas Electronics Corporation

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38C1 Group

S/W Remote Control Carrier Wave Generation

1. Overview

The following article provides an application example of S/W remote control carrier wave generation by 38C1 Group of microcomputers.

2. Introduction

The example introduced in this application note is applied to the following condition:

- Applicable Microcomputer: 38C1 Group
- Voltage: 2V - 3V
- Oscillation Frequency: 2 MHz
- Operation mode: High-speed mode

Due to the bit location for SFR, a bit with no function may be operated in some cases. It is possible to set values on those bits optionally.

3. Contents

3.1 Application Example of Carrier Wave Output Control

Outline

- Switch “H” and “L” of carrier wave using SEB instruction or CLB instruction.
- Determine the interval period between “H” and “L” in accordance with the processing frequency of NOP (two-cycle order) or TST (three-cycle order).
- While P52/CNTR0 carrier wave output is not performed, set values by counting the carrier wave generated internally or counting other internal functions having the same interval as the carrier wave.

Specification

- Carrier wave: 37.9 kHz, Duty 1/3
- P52/CNTR0 output: 9 ms output On – 4.5 ms output Off – 0.56 ms output On

3.1.1 Generating Carrier Wave

(1) Ideal carrier wave

Figure 1. below depicts the ideal carrier wave. The ideal carrier wave is constituted with 8.79 μs for “H”, 17.58 μs for “L”, and 26.37 μs for a cycle when the carrier frequency is 37.9 KHz and duty is 1/3.

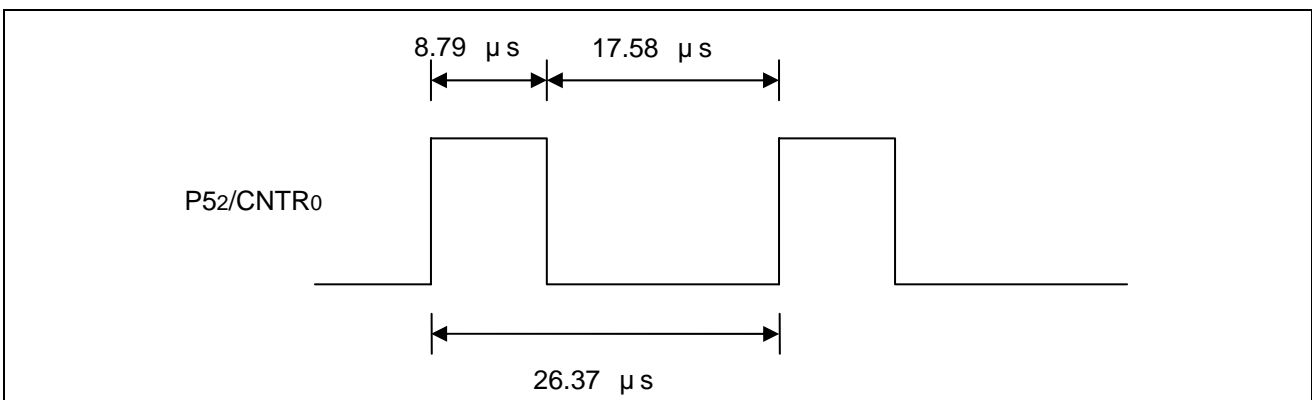


Figure 1. Ideal Carrier Wave

(2) Carrier wave generated by the 38C1Group of microcomputers

Generate carrier wave with the 38C1 Group of microcomputers. The execution period is 1 μs per a cycle under the following condition: Oscillation frequency f(XIN)=2 MHz; and high-speed mode f(XIN)/2. In other words, by using the combination of NOP and TST, it is possible to accomplish setting values at every 1 μs during “H” and “L” periods.

As far as this application example, NOP and TST are used; however, it is possible to employ other instructions to perform settings for “H” and “L” periods as long as it does not have any influence on the procedure of remote control carrier wave generation.

Figure 2. shows a carrier wave created as a practical example. Generate carrier wave having an interval of 26.5 μs by outputting two kinds of carrier waves by turns, i.e., 26 μs (“H”: 9 μs; “L”: 17 μs) and 27 μs (“H”: 9μs; “L”: 18 μs). The frequency is 37.7 kHz and the Duty is 0.334 for this carrier wave.

An error margin of the carrier wave with a 26- μ s interval is 1.4 %, while it is 2.3 % for the carrier wave with a 27- μ s interval. On the contrary, the carrier wave with an average interval of 26.5 μ s has an error margin of 0.5%; thus this is the closest to the ideal carrier wave.

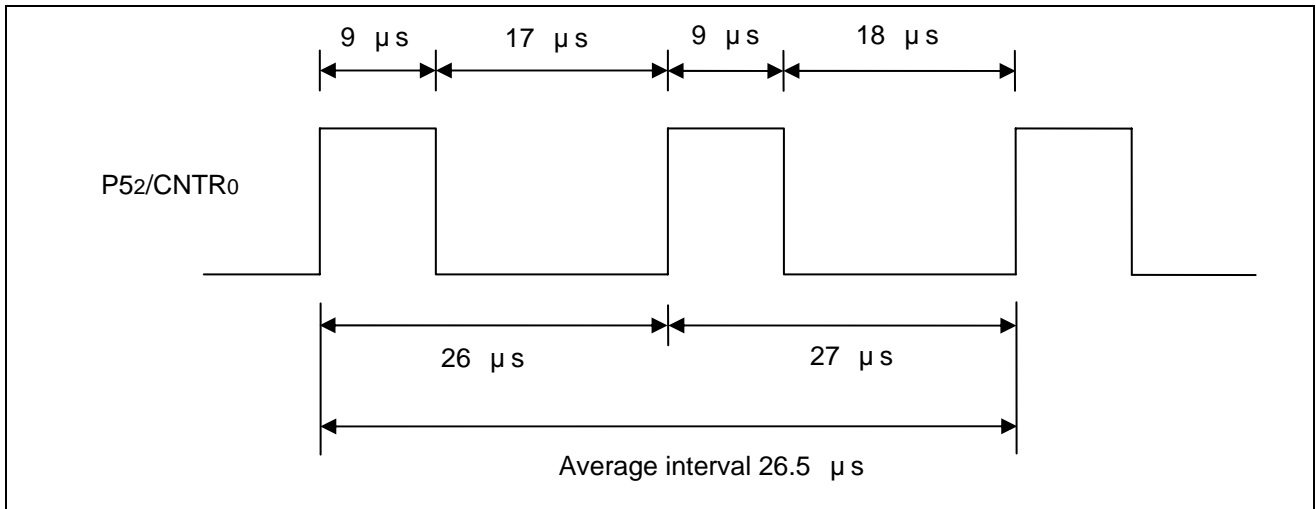


Figure 2. Carrier Wave with a 26.5- μ s Interval

3.1.2 P52/CNTR0 Carrier Wave Output

Figure 3. illustrates carrier wave output from P52/CNTR0 pin, whereas Figure 4. shows count values for each interval. Index register X is employed to count for both output and non-output intervals.

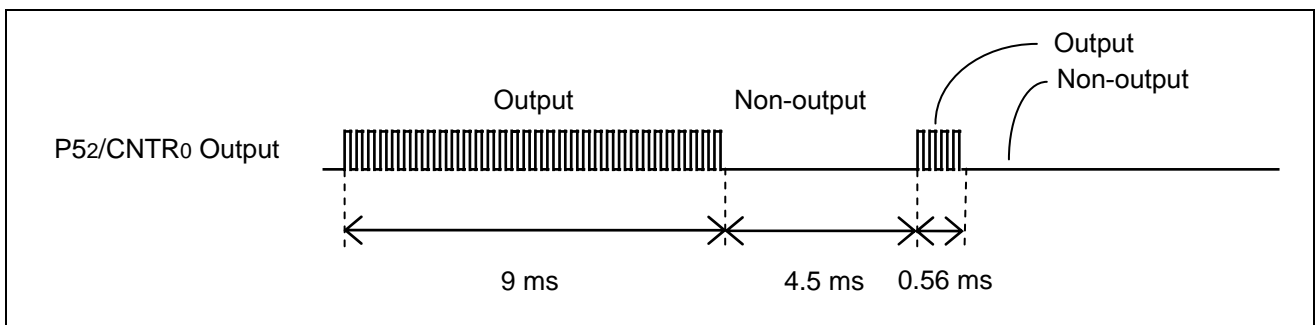


Figure 3. P52/CNTR0 Output

(Output – Non-output interval period)		(Count Value)
9-ms Output	= Carrier equivalent time : 26.5 μ s X	342
4.5-ms Non-output	= Carrier equivalent time : 26.5 μ s X	170
0.56-ms Output	= Carrier equivalent time : 26.5 μ s X	22

Figure 4. Count Value for Each Interval

3.2 Relevant Register Setting

Figure 5. bellow explains the relevant register setting.

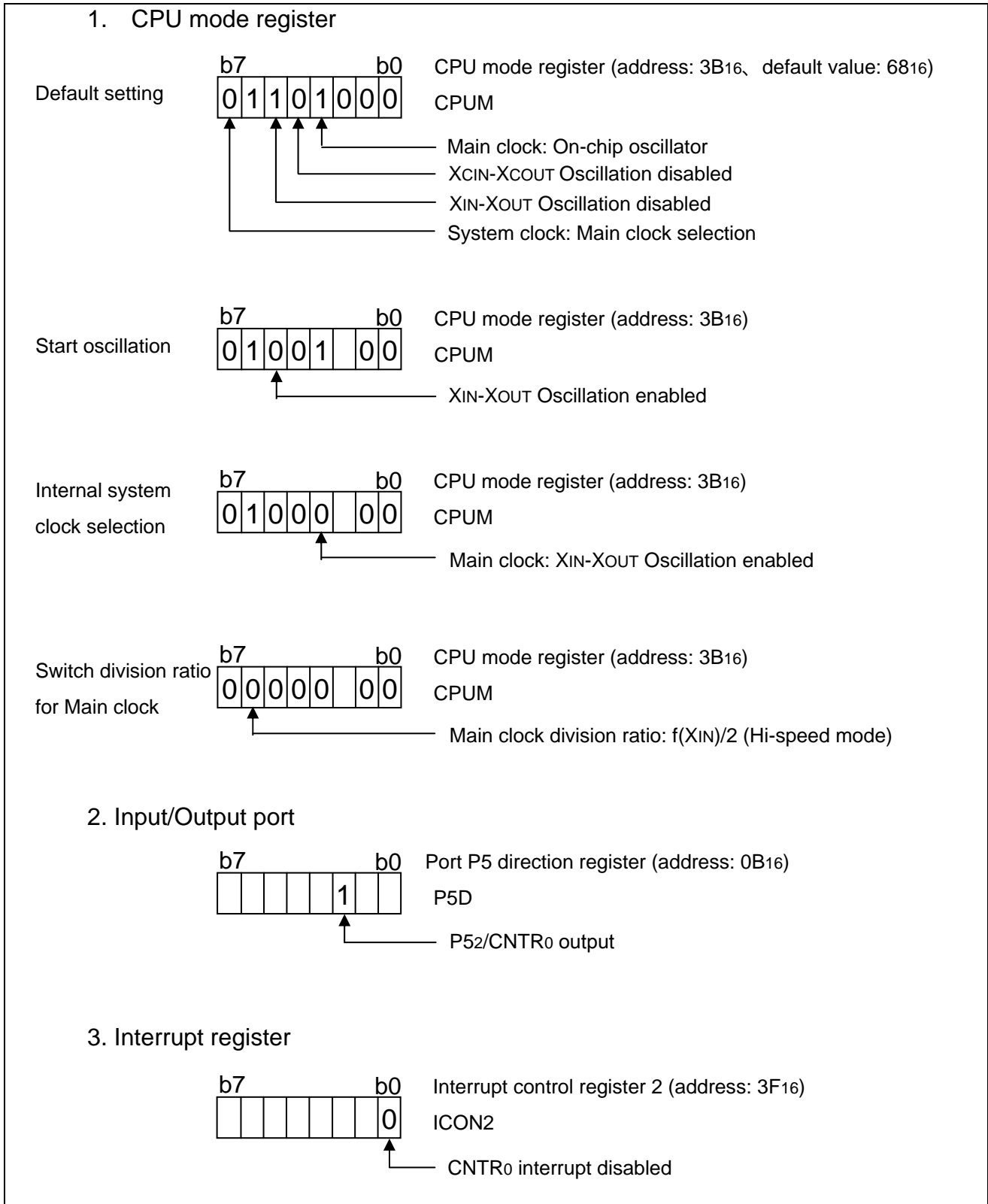


Figure 5. Relevant Register Setting

3.3 Control Procedure

Figure 6. displays an example of control procedure.

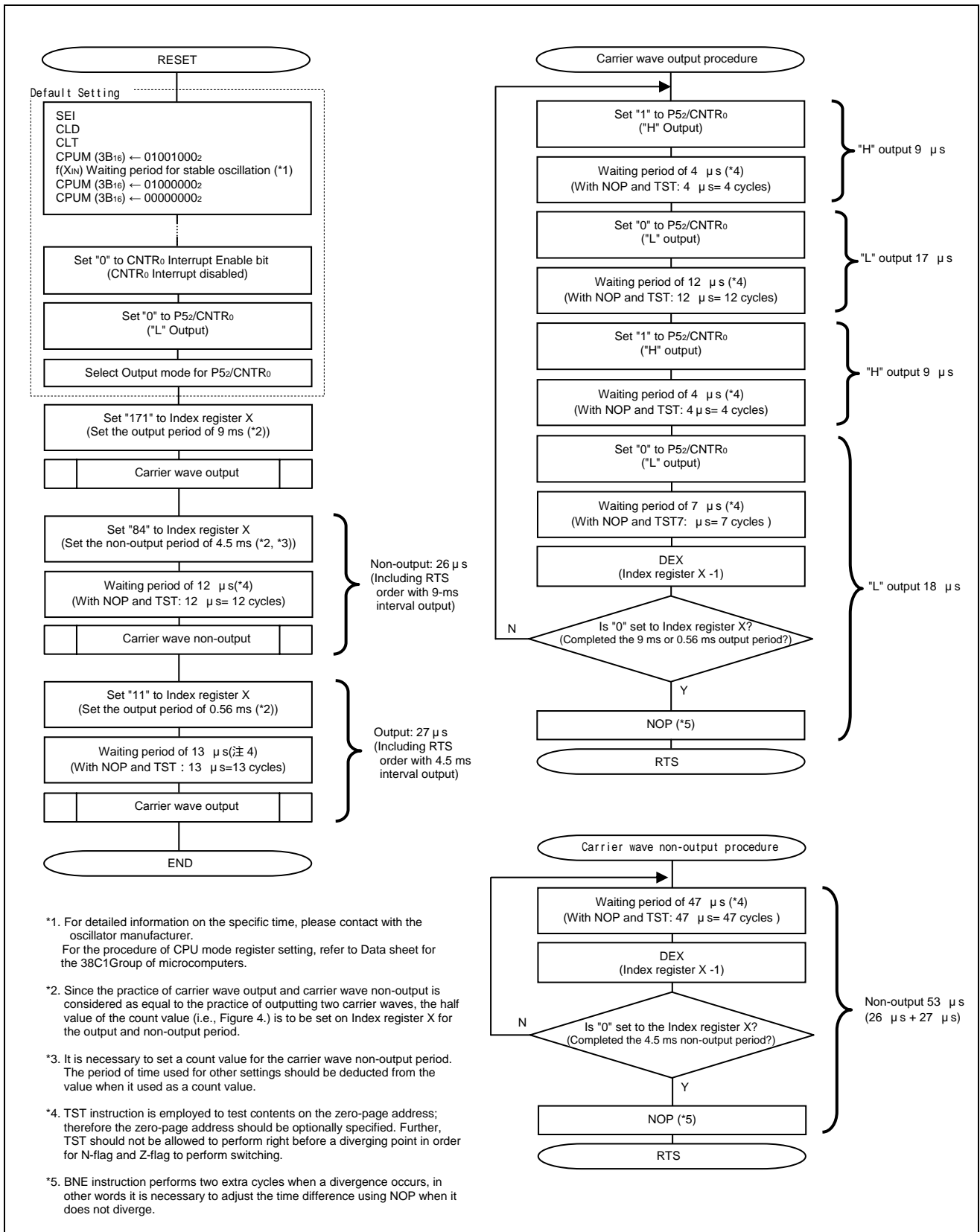


Figure 6. Example of Control Procedure

4. Reference Software Programs

Reference software programs are available on Renesas Technology Corporation Home Page.
To obtain the programs, click "Application Note" on the left side of the page for the 38C1 Group of microcomputers.

5. Reference Documents

Data Sheet

38C1Group Data Sheet

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Revision History	38C1 Group S/W Remote Control Carrier Wave Generation
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Rev.	Date	Description	
		Page	Summary
1.00	2006.05.17	—	First edition issued

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