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April 1st, 2010
Renesas Electronics Corporation

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H8S / 2200 Series

Measuring the High- and Low-Level Periods of a Pulse

Introduction

Measures the high and low widths of a pulse, and stores the result in the RAM.

Target Device

H8S / 2215

Contents

1. Specifications

(1) Measures the low and high periods of a pulse and stores the results in the on-chip RAM, as shown in figure 1.
(2) In operation at 20 MHz, the measurement of pulses with high and low widths is possible for every 50 ns between 1.9 µs and 3.27 ms.

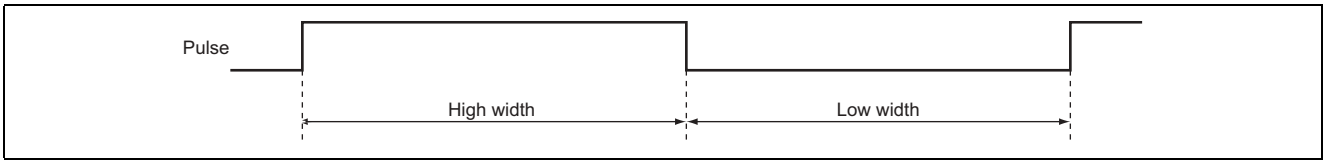


Figure 1 Timing of the Measurement of Pulse Width

2. Description of Function Usage

(1) The high and low widths of the pulse are measured by using TPU0.

(a) The following functions are used; a block diagram is given in figure 2.

- Detection of the rising and falling edges of pulses and setting of the timer value at the time in the internal register (input capture)
- Clearing of the timer counter on generation of the input capture
- Starting up interrupt handling on detection of the rising or falling edge of a pulse

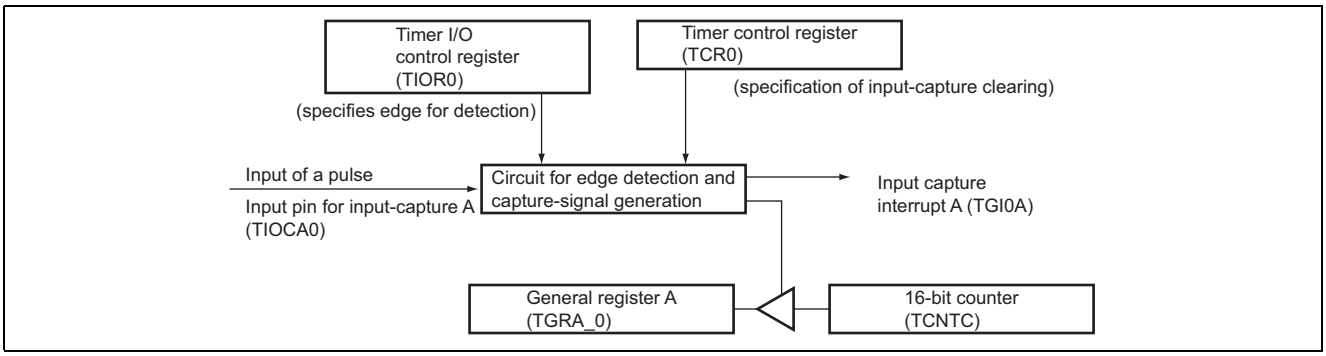


Figure 2 Blocks Used in Measuring the High and Low Periods of a Pulse

(2) Usage of functions in this sample task is described in table 1. Measurement of the high and low widths of a pulse is achieved by using the functions as described in this table.

Table 1 Function Assignments

Element	Description
TCR0	Sets the source for counter clearing
TIOR0	Selects the input-edge of the input-capture signal
TIOCA0	Inputs the pulse to be measured
TGRA_0	Detects the counter value on rising and falling edges of the pulse
TGI0A	Starts measurement of the high and low widths of the pulse on rising and falling edges

3. Principles of Operation

An outline of task operation is given in figure 3. As the figure shows, a combination of hardware and software processing is used to measure the high and low widths of the pulse.

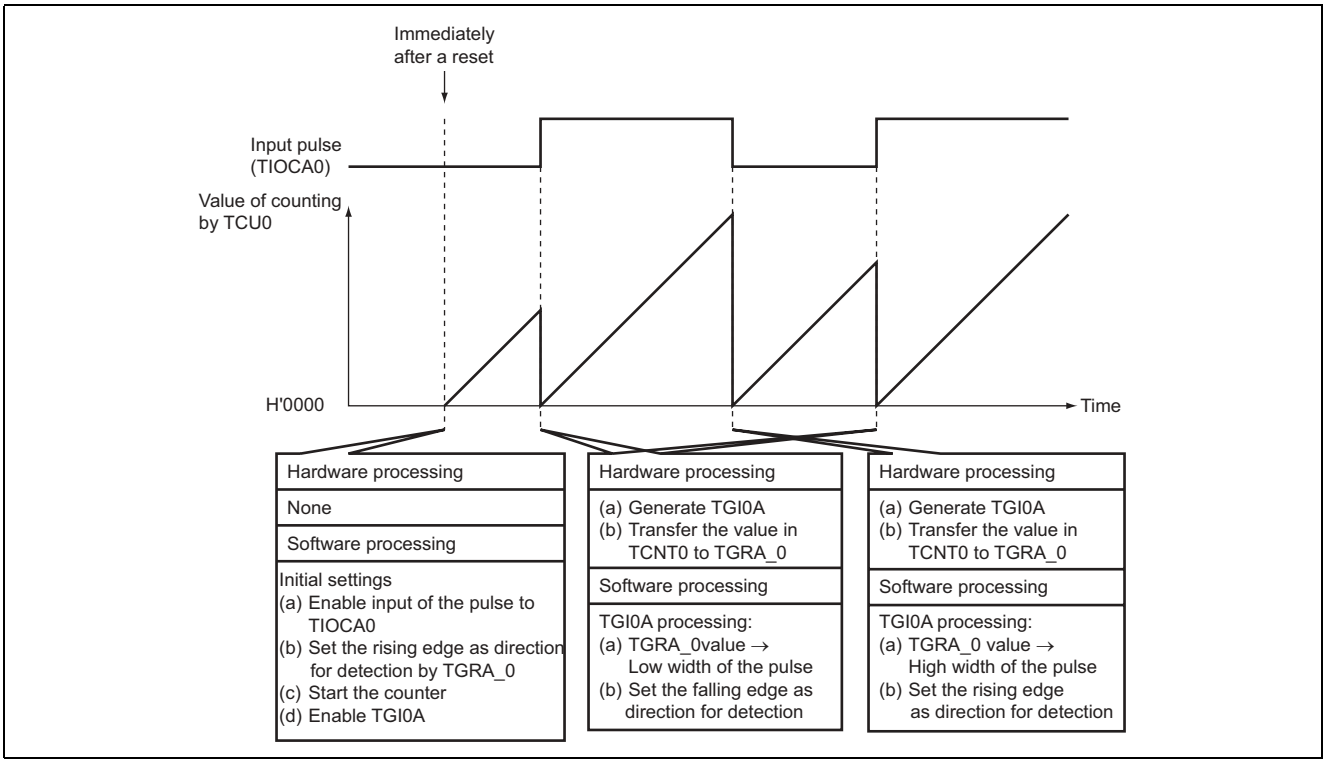


Figure 3 Measuring the Pulse Width

4. Software Description

(1) Function

Function	Label	Description
Main routine	PWHLN	Initializes setting of the TPU and RAM
Measurement of high/low periods	PWHL1	Initiated by TGI0A; reads the values of TGRA_0 that indicate the high and low periods of the pulse and places them in RAM

(2) Arguments

Label	Description	Data Type	Used in	I/O
pwh_hdata	Sets the timer value for the high period of the pulse. The period is obtained by this expression: pulse-high width (ns) = timer value x ϕ (cycle time, 50 ns in operation at 20 MHz)	unsigned short	Measurement of high and low periods of the pulse	Output
pwh_ldata	Sets the timer value for the low period of the pulse. The period is obtained by this expression: pulse-low width (ns) = timer value x ϕ (cycle time, 50 ns in operation at 20 MHz)	unsigned short		

(3) Internal Registers

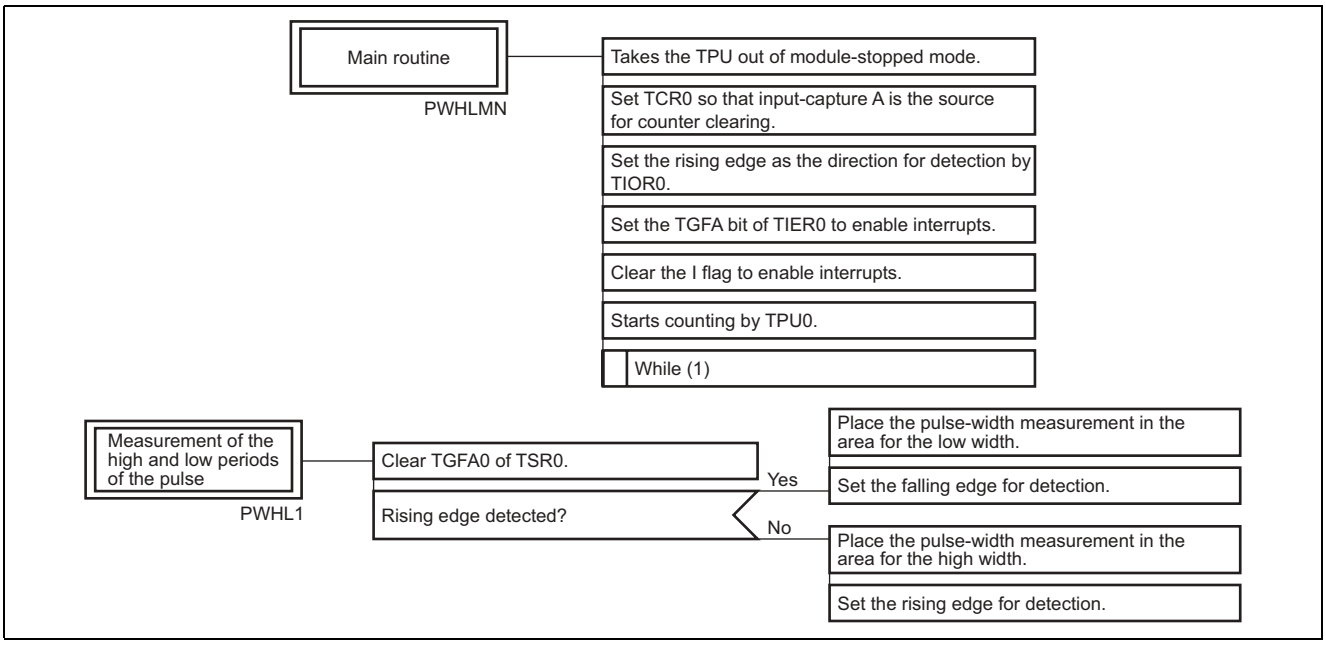
Register	Description	Used in
TSTR	Starts/stops the timer counter	Main routine
TCR0	Selects the TCNT counter clock, and sets input-capture A as the source for clearing the counter	Main routine, measurement of the high and low periods of the pulse
TIOR0	Sets the transfer value in TCNT to TGRA_0 on detection of the rising or falling edge of the pulse	Main routine
TIER0	Enables generation of TGI0A interrupts	Main routine
TGRA_0	Sets the values of TCNT on rising and falling edges of the pulse signal for measuring the pulse cycle	Measurement of the high and low periods of the pulse
TSR0	Indicates the generation of input-capture A	Measurement of the high and low periods of the pulse
MSTPCR	Takes the TPU out of module-stopped mode	Main routine

(4) RAM Usage

In this sample task, no RAM is used other than that for argument storage.

5. PAD

(1) Main routine



Revision Record

Rev.	Date	Description	
		Page	Summary
1.00	Mar.16.04	—	First edition issued

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