RH850/U2Bx

ENCA(Encoder Timer A)

Summary

This application note describes how RH850/U2B6 uses the ENCA input signal to achieve counter clearing and capture. The operation examples shown in this application note have been confirmed to work, but please be sure to check the operating environment before using the product.

Operation confirmation device

RH850/U2B6-FCC (R7F702Z22EDBB)

Table of contents

1. Introduction

In this application note, the capture operation performed at the time of clearing by ENCAnEC, ENCAnE0, ENCAnE1 in ENCA in RH850/U2B6-FCC and the input selection of ENCA by PIC are described.

1.1 Functions

The hardware functions of RH850/U2B6 used in this application note are shown below.

- ENCA (Encoder timer)
- PIC (Peripheral Interconnect)

2. Capture operation performed when clearing by ENCAnEC, ENCAnE0, ENCAnE1

This chapter shows an example of a capture operation that clears the ENCA0 counter with the three input signals ENCA0EC, ENCA0E0, and ENCA0E1. The input to ENCA0 feeds the signal from encoder signal group 0 pin via the PIC1.

2.1 Operation overview

Clear the timer and perform the capture operation of ENCA0.

When an external input signal is input to ENCA0 by PIC1, ENCA0 counts up the counter as the ENCA0E0 and ENCA0E1 inputs change. If the inputs are ENCA0E0 = Low, ENCA0E1 = Low, ENCA0EC = High, ENCA clears the counter and ENCA0CCR1 captures the value of the counter. At this time, the capture interrupt INTENCA0I1 and the clear interrupt INTENCA0IEC are generated. The value of the counter is read by the generated capture interrupt.

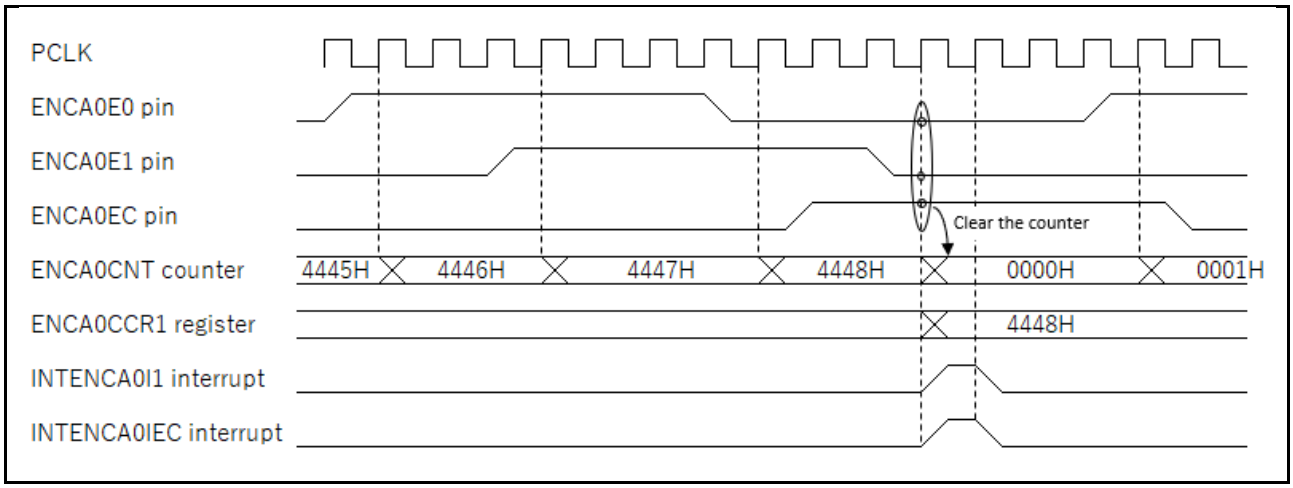

Figure 2-1 ENCA0 operation overview

2.2 Operation flowchart

Figure 2-2 shows the operation flowchart of this operation example.

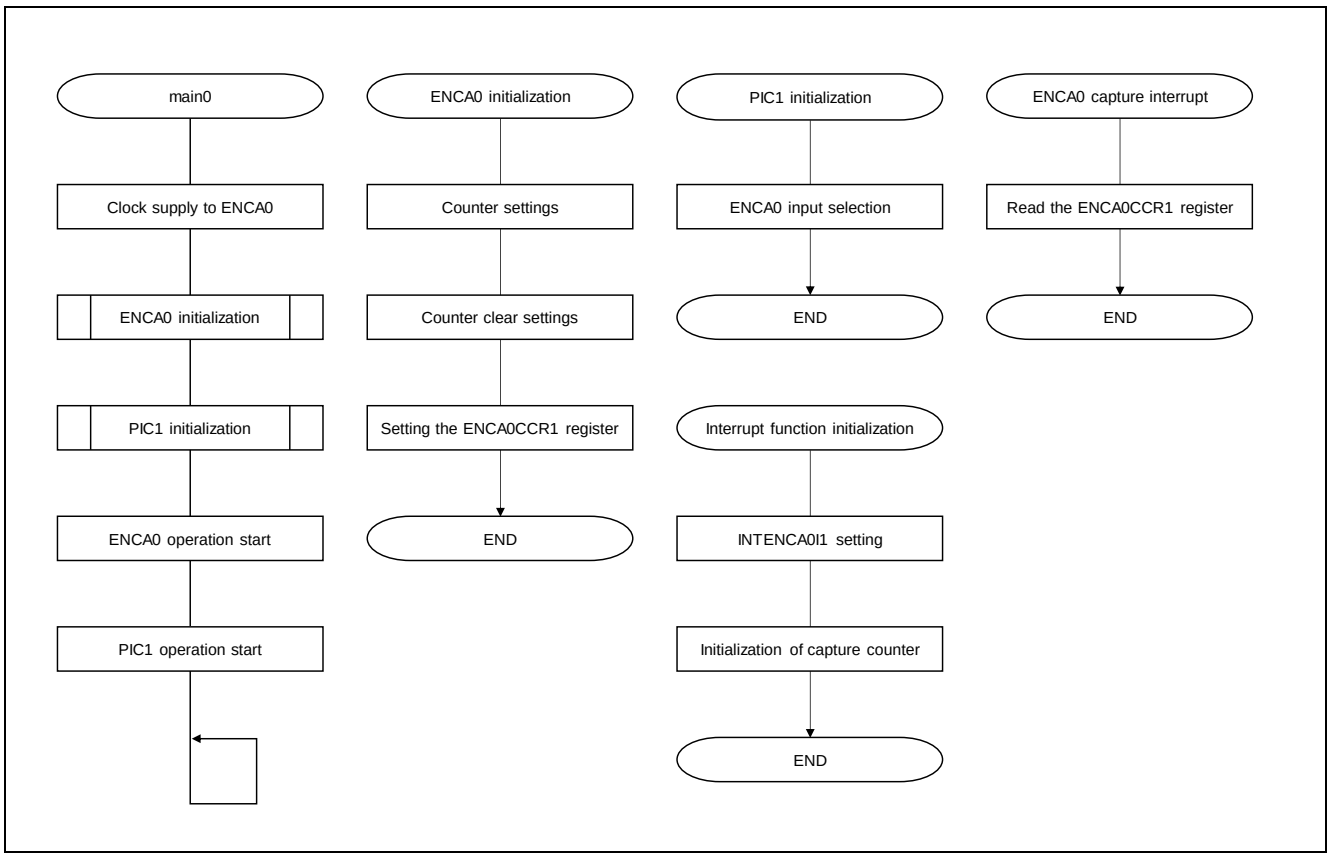

Figure 2-2 ENCA0, PIC1 operation flowchart

2.3 Software description

Table 2-1 to 2-4 show a setting example of each register used in this operation example.

Table 2-1 Register setting example (ENCA0)

Register name	Set value	Function
ENCA0CTL	0x0283	Use ENCA0CCR1 as the capture register Use encoder clear signal as capture trigger Detection of both ends of ENCA0E0 and ENCA0E1
ENCA0IOC1	0xC0	Clear the counter when the following input status is detected ● ENCA0EC = High ● ENCA0E1 = Low ● ENCA0E0 = Low
ENCA0TS	0x01	ENCA0 timer start

Table 2-2 Register setting example (PIC1)

Register name	Set value	Function
PIC1SSER02	0x1000	ENCA0 simulation start trigger enabled
PIC1REG30	0x00000000	Use ENCA0E0 pin input for ENCAT0E0
		Use ENCA0E1 pin input for ENCAT0E1
		Use ENCA0EC pin input for ENCAT0EC

Table 2-3 Register setting example (Interrupt)

Register name	Set value	Function
EIC311	0x0041	INTENCA0I1 (Capture) Table reference method / Priority level 1

Table 2-4 Register setting example (Port)

Register name	Set value	Function
PFCEAE2	0x0007	P2_0, P2_1, P2_2: ALT_IN13 (Alternative input mode 13)
PFCAE2	0x0007	
PFCE2	0x0000	
PFC2	0x0000	
PM2	0x0007	
PMC2	0x0007	
PIPC2	0xFFF8	P2_0, P2_1, P2_2 : Software I / O control

Tables 2-5 to 2-6 show a list of functions and variables used in this operation example.

Table 2-5 Function list

Function name	Overview
main0	Call each function, Main processing
port_init	Port initialization
enca0_init	ENCA0 initialization
pic1_init	PIC1 initialization
int_cpu0_init	Interrupt function initialization
int_enca0_capture	ENCA0 capture interrupt

Table 2-6 Variable list

Variable name	Overview
g_u2t_counter_capture	Save the captured value

3. ENCA input signal selection of PIC

This chapter shows an example of selecting the input signal of ENCA by PIC.

The ENCA input selection of the PIC1 connects ENCA1 to the encoder signal group 0 pin.

3.1 Operation overview

Set ENCA1 to clear and capture counters by ENCA0EC, ENCA0E0, and ENCA0E1. As the input signal to the set ENCA1, the signal from the encoder signal group 0 pin is selected by PIC1 and supplied.

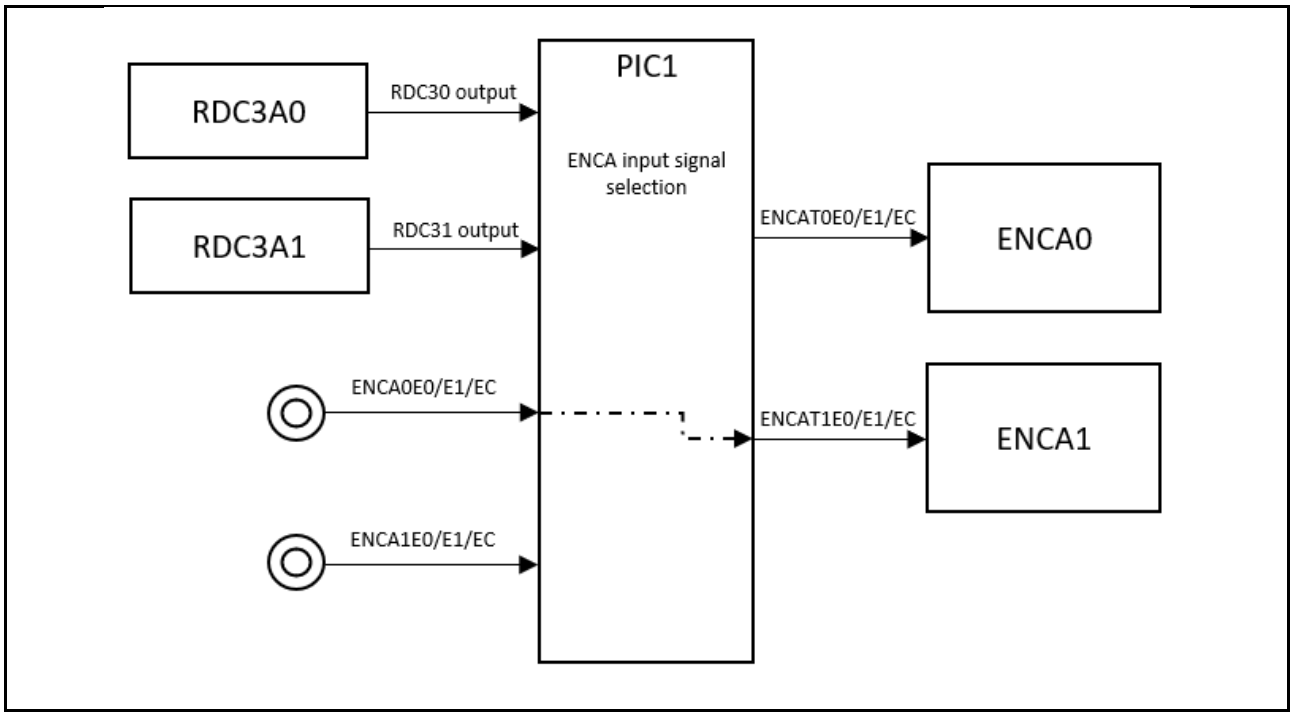

Figure 3-1 PIC1 operation overview

3.2 Operation flowchart

Figure 3-2 shows the operation flowchart of this operation example.

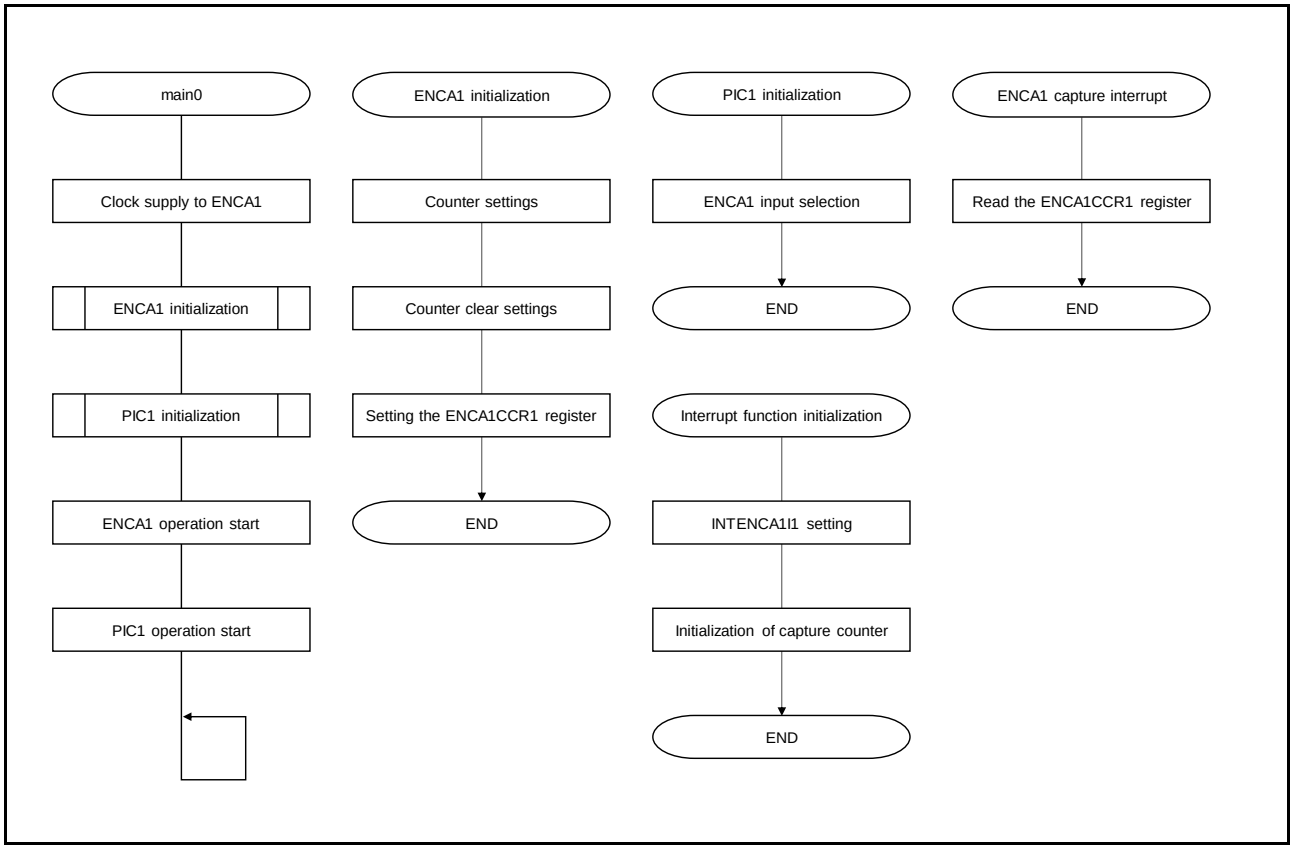

Figure 3-2 ENCA1、PIC1 operation flowchart

3.3 Software description

Table 3-1 to 3-4 show a setting example of each register used in this operation example.

Table 3-1 Register setting example (ENCA1)

Register name	Set value	Function
ENCA1CTL	0x0283	Use ENCA1CCR1 as the capture register
		Use encoder clear signal as capture trigger
		Detection of both ends of ENCA1E0 and ENCA1E1
ENCA1IOC1	0xC0	Clear the counter when the following input status is detected ● ENCA1EC = High ● ENCA1E1 = Low ● ENCA1E0 = Low
ENCA1TS	0x01	ENCA1 timer start

Table 3-2 Register setting example (PIC1)

Register name	Set value	Function
PIC1SSER02	0x2000	ENCA1 simulation start trigger enabled
PIC1REG30	0x00000940	Use ENCA0E0 pin input for ENCAT1E0
		Use ENCA0E1 pin input for ENCAT1E1
		Use ENCA0EC pin input for ENCAT1EC

Table 3-3 Register setting example (Interrupt)

Register name	Set value	Function
EIC423	0x0041	INTENCA1I1 (Capture) Table reference method / Priority level 1

Table 3-4 Register setting example (Port)

Register name	Set value	Function
PFCEAE2	0x0007	P2_0, P2_1, P2_2: ALT_IN13 (Alternative input mode 13)
PFCAE2	0x0007	
PFCE2	0x0000	
PFC2	0x0000	
PM2	0x0007	
PMC2	0x0007	
PIPC2	0xFFF8	P2_0, P2_1, P2_2 : Software I / O control

Table 3-5 to 3-6 show a list of functions and variables used in this operation example.

Table 3-5 Function list

Function name	Overview
main0	Call each function, Main processing
port_init	Port initialization
enca1_init	ENCA1 initialization
pic1_init	PIC1 initialization
int_cpu0_init	Interrupt function initialization
int_enca1_capture	ENCA1 capture interrupt

Table 3-6 Variable list

Variable name	Overview
g_u2t_counter_capture	Save the captured value

Revised record

Rev.	Date of issue	Revised contents	
		page	point
1.00	2022.06.30	-	First edition issued

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   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on

   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state

   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins

   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.
5. Clock signals

   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
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   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
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