# RH850/U2Bx

## High-Resolution PWM (HRPWM)

### Summary

This application note describes how to use the HRPWM of RH850/U2B6. 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

This application note describes that how to add a delay to the PWM signal using the HRPWM of RH850/U2B6-FCC.

## 1.1 Functions

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

- High-Resolution PWM（HRPWM）
- TSG3（Motor Control Timer）
- PIC（Peripheral Interconnect）

# 2. HRPWM output

The HRPWM can be added some delay to a complementary PWM waves generated by GTM or TSG3. The delay can be set individually to each phase. In this application note, it shows the example of the adding a delay to PWM waves by HRPWM. The PWM waves are generated by the HT-PWM mode of TSG3.

Please set the Option Byte shown in Table **2-1** when using this function.

Table 2-1 Option Byte setting

| Register name | Value | Operations |
|---|---|---|
| OPBT8.CKSEL_HRPWM | 11b | Clock source select for HR-PWM : Set when HRPWM is used with TSG3 |

## 2.1 Operation overview

The HRPWM can be output the PWM wave with delay according to the setting value of it. The PWM waves are generated by TSG3.

The TSG31 and TSG32 can be used in conjunction with the HRPWM. In this application note, the TSG31 is used. The operation overview is shown in Figure **2-1**.

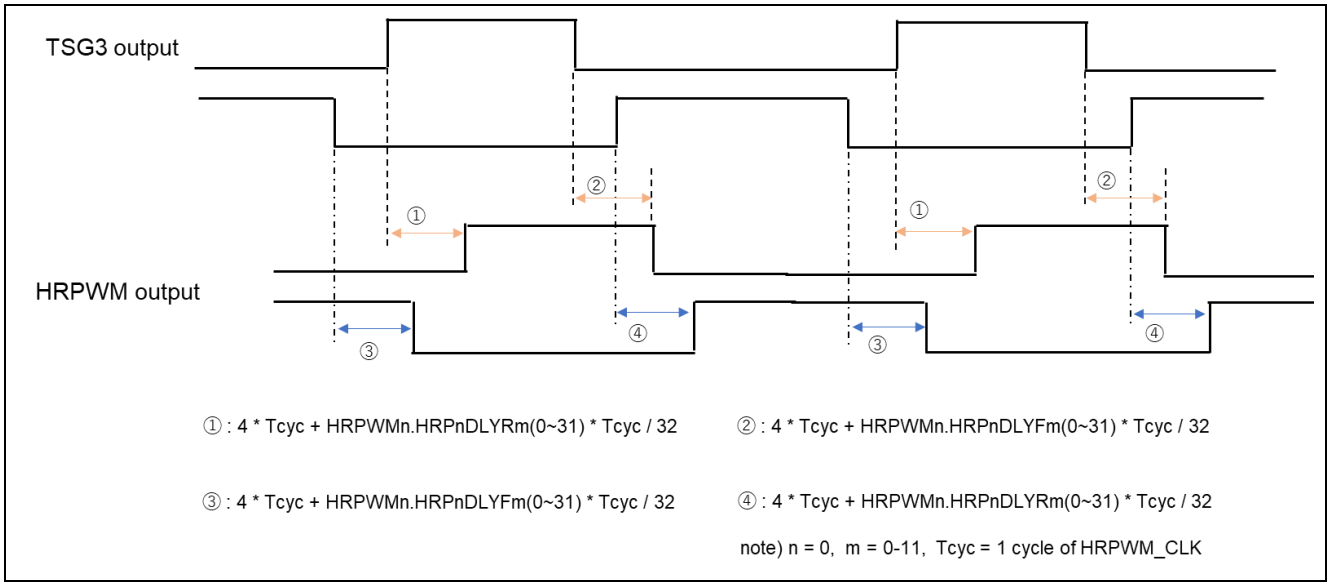


Figure 2-1 Operation overview of outputting the PWM waves with delay

## 2.2 Flowchart

The flowcharts are shown in Figure **2-2**.

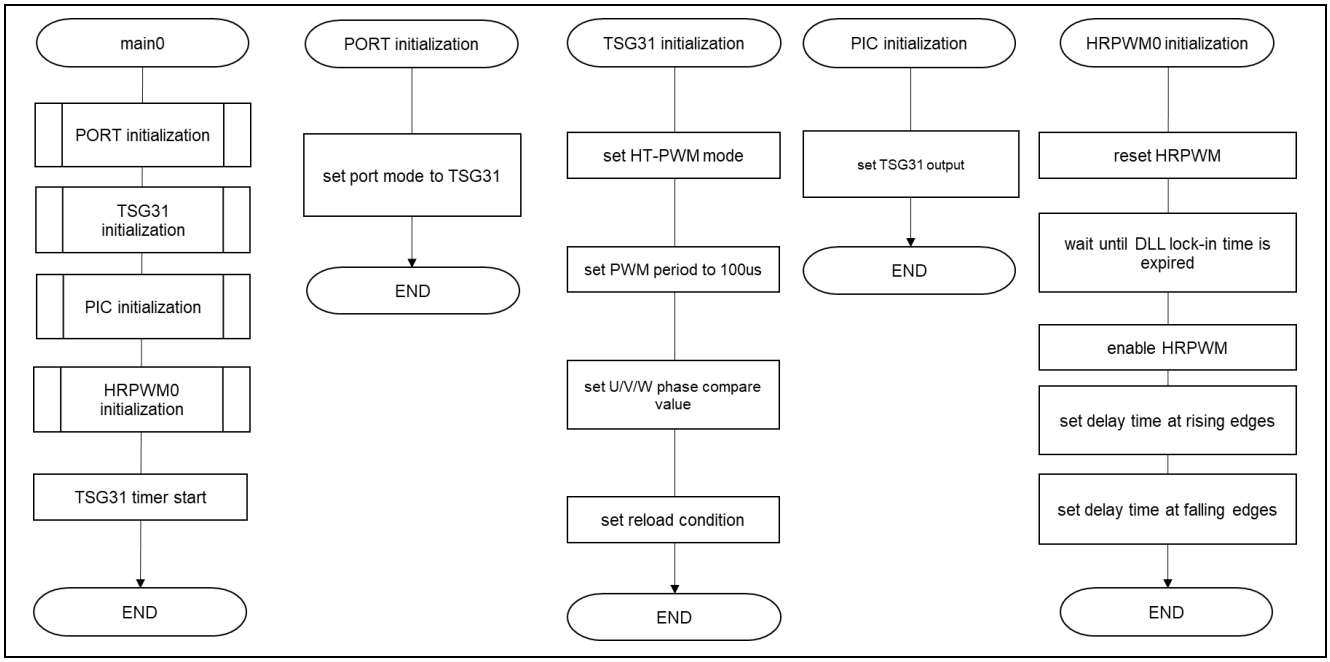


Figure 2-2 Flowchart of operation of PWM waves

## 2.3 Software operation

This chapter describes the software setting of this example.
The Register settings are shown at Table **2**-**2**, Table **2**-**3**, Table **2**-**4**, Table **2**-**5**.

Table 2-2 Register setting (HRPWM0)

| Register name | Set value | Operations |
|---|---|---|
| HRP0DLYCTR | 0x03 -> 0x01 | PWM Delay Circuit Reset, and DLL Operation is enabled. |
| HRP0DLYEN | 0x0003F | PWM Delay Circuit Channel 0 to 5 are enabled. |
| HRP0DLYR0-5 | 0x10 | PWM delay value setting which will be appended to rising edges.<br>0x10 = 16/32 of HRPWM_CLK |
| HRP0DLYF0-5 | 0x10 | PWM delay value setting which will be appended to falling edges.<br>0x10 = 16/32 of HRPWM_CLK |

Table 2-3 Register setting (TSG31)

| Register name | Set value | Operations |
|---|---|---|
| TSG31CTL0 | 0x01 | Select timer mode to T-PWM mode. |
| TSG31CTL4 | 0x00000080 | Enables reload operation at the peak timing of the 18-bit counter. |
| TSG31CMP0E | 0x00001F40 | Set the PWM cycle as 100 usec. |
| TSG31CMPUE | 0x00000FA0 | Set the U-phase compare value (50% duty ratio). |
| TSG31CMPVE | 0x00000FA0 | Set the V-phase compare value (50% duty ratio). |
| TSG31CMPWE | 0x00000FA0 | Set the W-phase compare value (50% duty ratio). |
| TSG31TRG0 | 0x01 | The TSG31 timer is started. |

Table 2-4 Register setting (PIC1)

| Register name | Set value | Operations |
|---|---|---|
| PIC1LHSEL1 | 0x00 | Selects low/high level output of the TSG31 output. |
| PIC1TSGOUTCTR1 | 0x00 | Set output low/high level as TSG31 output is available. |

Table 2-5 Register setting (PORT)

| Register name | Set value | Operations |
|---|---|---|
| PORT0.PCR00_6 | 0x00000060 | Set port output mode as TSG31O1_H. |
| PORT0.PCR02_0 | 0x00000069 | Set port output mode as TSG31O2_H. |
| PORT0.PCR02_1 | 0x00000063 | Set port output mode as TSG31O3_H. |
| PORT0.PCR02_2 | 0x00000069 | Set port output mode as TSG31O4_H. |
| PORT0.PCR02_3 | 0x00000068 | Set port output mode as TSG31O5_H. |
| PORT0.PCR02_4 | 0x00000067 | Set port output mode as TSG31O6_H. |

The software functions are shown in Table **2**-**6**.

Table 2-6 Software functions

| Function name | Overview |
|---|---|
| main0 | Main application |
| hrpwm_init | HRPWM initialization |
| tsg3_init | TSG31 initialization |
| pic_init | PIC1 initialization |
| port_init | PORT initialization |

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   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.
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