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Renesas Electronics Corporation

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38D2 Group

Low Power Consumption for Remote Controller

1. Abstract

The following article describes how to achieve low power consumption for the remote controller using 38D2 Group device.

2. Introduction

The explanation of this issue is applied to the following MCU and conditions:

- Applicable MCU: 38D2 Group
- Oscillation frequency: f(XIN) = 4 MHz, f(XCIN) = 32.768 KHz
- Memory size: 24 KB ROM, 640 bytes RAM

3. Contents

3.1 Selecting and Switching Clocks

- Outline

  The following explains how to select and switch clocks to achieve MCU low power consumption.

  — Selecting XCIN as a count source for function modules such as timers or the LCD display is most effective in achieving low power consumption. If the count length of an 8-bit timer is not long enough, one 16-bit timer or two 8-bit timers is available.

  — When selecting XIN as a count source for function modules, start oscillating XIN just before using the function. Then, stop oscillating just after completing use of the function in order to lower power consumption as much as possible.

  — In many cases, selecting XCIN as the system count source is the most effective method. Do not oscillate XIN until necessary.

- Example

  The following are setting examples when designing a remote controller with an LCD display:

  — Timer X is used to output 38 KHz carrier wave, and its count source is XIN.

  — Timer 3 is used to control a carrier wave, and its count source is XIN.

  — Timer 1 and timer 2 are combined to generate 250 ms count, and its count source is XCIN.

  — The count source for the LCD display module is XCIN.

  — If no key is pressed and no IR signal needs to be transmitted, the system count source is XCIN, so stop the XIN. Just before key wake-up or IR signal needs to be transmitted, make XIN oscillate, and then wait until it is stabilized and switch XIN as system count source.

3.2 Switching Power Control Modes

When no key pressed, select XCIN as the system clock source and set the MCU to enter WIT mode to reduce power consumption. Do not use STP mode since the LCD drive module does not work in STP mode.

Figure 1 shows the flow chart for selecting/switching clocks and switching power control modes.

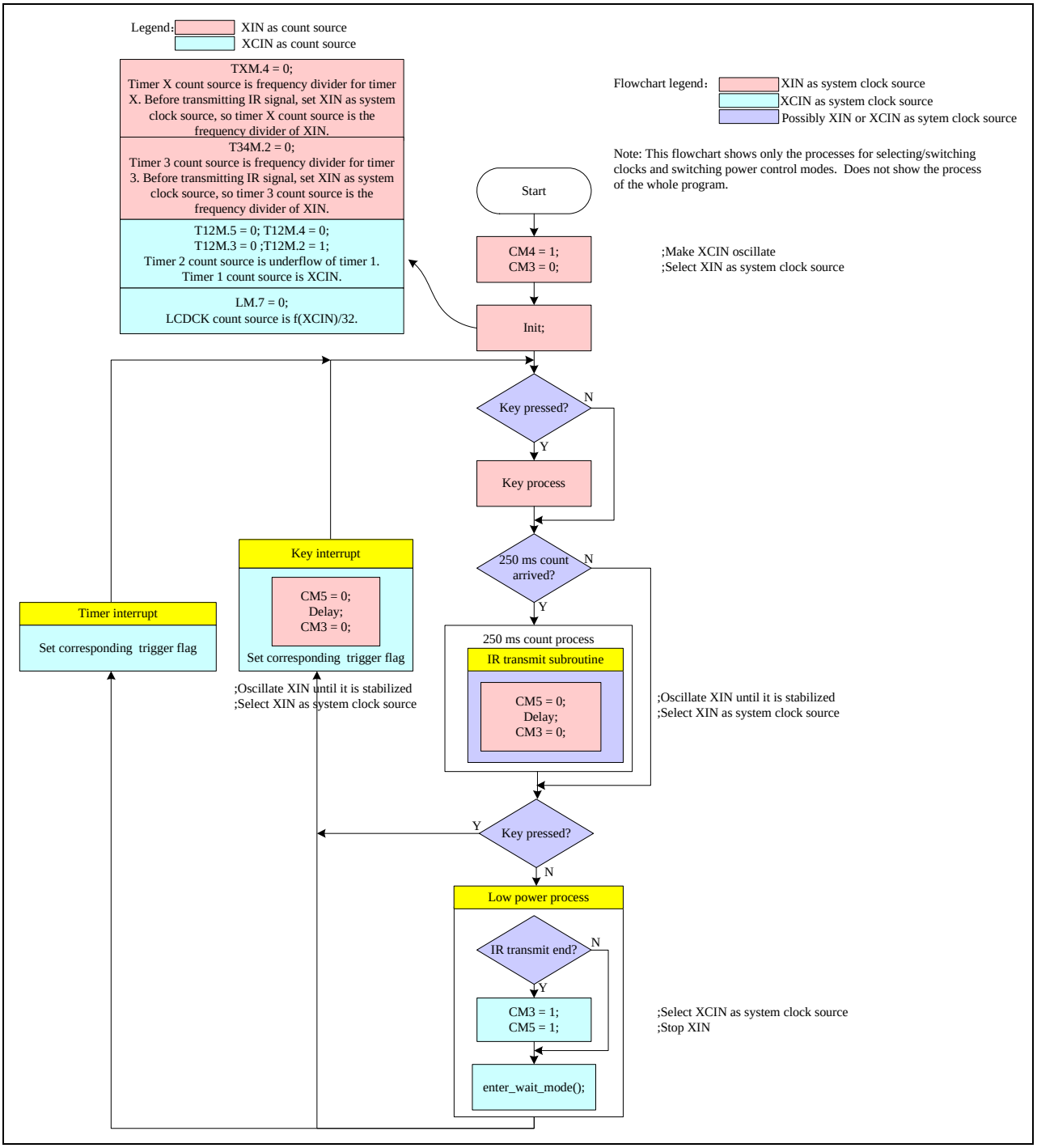

Figure 1 Flow Chart of Selecting/Switching Clocks in Work Mode

3.3 Other Related Settings

3.3.1 LCD Dividing Resistor Selection

Internal dividing resistor of LCD drive module is 200 KΩ. When selecting a dividing resistor larger than 200 KΩ, use the external dividing resistor. Although a larger resistor achieves lower power consumption, a larger resistor leads to lower LCD display brightness. Therefore, select the most appropriate dividing resistor to lower power consumption while keeping an appropriate LCD brightness.

3.3.2 AD Ladder Resistor

The connection between the ladder resistor and reference voltage input pin (VREF) can be controlled by the VREF input switch bit (bit 0, address 0016_{16}). When "1" is written to this bit, the ladder resistor is always connected to the VREF. When "0" is written to this bit, the ladder resistor is disconnected from the VREF except during the A/D conversion. When designing a remote controller with AD sample, set this bit to "0" to reduce system power consumption.

Figure 2 shows the comparison of system power consumption.

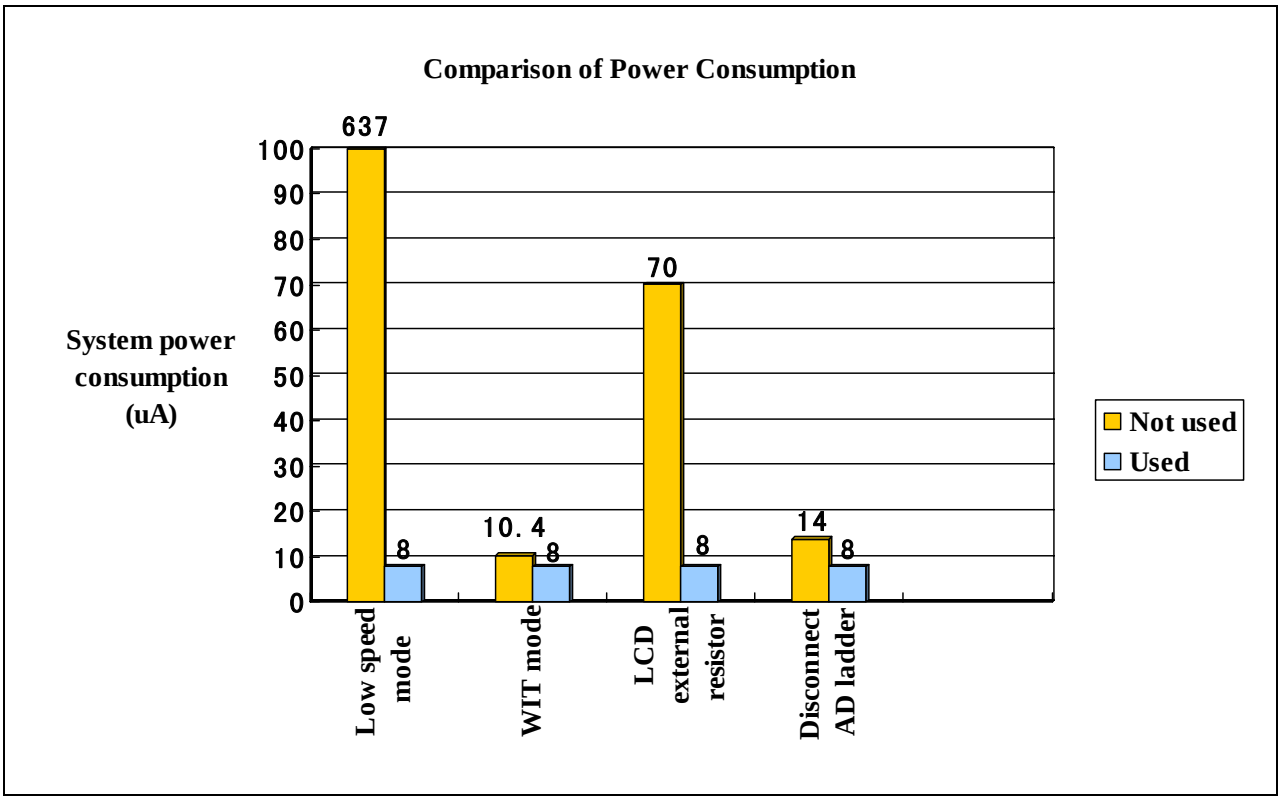

Figure 2 Comparison of System Power Consumption

Notes:

- When XIN is selected as the system clock source, the frequency of the system clock is XIN/2. When XCIN is selected as the system clock source, the frequency of the system clock is XCIN/2.
- LCD external dividing resistor is 3 MΩ, internal dividing resistor is 200 KΩ.
- Test voltage is 2.50 V. System power consumption may change if a different working voltage is used.
- System power consumption may change if a different system circuit is used.

4. Reference Documents

Hardware Manual
38D2 Group Datasheet
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.

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