RX Family

Aeropoint Module Firmware Integration Technology

Introduction

This application note describes the Aeropoint module which uses Firmware Integration Technology (FIT). This module is hereinafter referred to as "the Aeropoint FIT module".

Target Device

・RX65N group、RX651group   ROM capacity：1.5MB to 2MB

・RX72N group   ROM capacity：1.5MB to 4MB

When this application note is applied to other Renesas MCUs, careful evaluation is recommended after making modifications to comply with the alternate MCU.

Target Compilers

・Renesas Electronics C/C++ Compiler Package for RX Family

For details of the confirmed operation contents of each compiler, refer to "2.7 Adding the FIT Module to Your Project".

Related Documents

● Firmware Integration Technology User's Manual (R01AN1833)
● RX Family Board Support Package Module Firmware Integration Technology (R01AN1685)

Contents

1. Overview

1.1 Aeropoint FIT Module

The Aeropoint FIT module is used as an API, by implementing in a project. Refer to "2.7 Adding the FIT Module to Your Project" for how to implement the Aeropoint FIT module into a project.

1.2 Overview of the Aeropoint FIT Module

The Aeropoint FIT module enables Aeropoint GUI to be easily implemented in a user's program with Smart Configurator by making Aeropoint GUI by CRI Middleware correspond to FIT.

For the details of Aeropoint GUI, refer to the document below.

・Aeropoint GUI User's Manual

2.   API information

This FIT module has been confirmed to operate under the following conditions.

2.1   Hardware Requirements

The MCU used must support the following functions:

- CMT
- GLCDC
- GPIO
- SCI
- MPC (when using RX651/65N)

In addition, the MCU used must support the following functions when the applications are used.

- When an SD card is used.

- DMAC
- ICU
- SDHI

- When an external flash memory is used.

- DMAC
- ICU
- I/O port
- QSPI

- When data communication (LAN) is used.

- EDMAC
- ETHERC

- When command communication (UART) is used.

- DMAC
- ICU

2.2   Software Requirements

This driver is dependent upon the following FIT module:

- Board Supprt Package Module (r_bsp) Rev.5.20 or higher
- CMT Module (r_cmt_rx) Rev.4.70 or higher
- Graphic LCD Controller Moduke (r_glcdc_rx) Rev.1.50 or higher
- GPIO Module (r_gpio_rx) Rev.3.60 or higher
- Simple I^{2}C Module (r_sci_iic_rx) Rev.2.46 or higher
- System Timer Module (r_sys_time_rx) Rev.1.01 or higher
- Multi-Function Pin Controller (r_mpc_rx) Rev.3.60 or higher (when using RX651/65N)

In addition, this driver is dependent upon the following FIT module when the applications are used.

- When an SD card is used.
  - DMAC Module (r_dmaca_rx) Rev.2.50 or higher
  - LONGQ Module (r_longq) Rev.1.81 or higher
  - SD Mode SD Memory Card Driver Module (r_sdc_sdmem_rx) Rev.3.00 or higher
  - SDHI Module (r_sdhi_rx) Rev.2.06 or higher
- When an external flash memory is used.
  - DMAC Module (r_dmaca_rx) Rev.2.50 or higher
  - Clock Synchronous Control Module for Serial Flash Memory Access (r_flash_spi) Rev.3.01 or higher
  - LONGQ Module (r_longq) Rev.1.81 or higher
  - Memory Access Driver Interface Module (r_memdrv_rx) Rev.1.03 or higher
  - QSPI Clock Synchronous Single Master Control Module (r_qspi_smstr_rx) Rev.1.14 or higher
- When data communication (LAN) is used.
  - Ethernet Module (r_ether_rx) Rev.1.21 or higher
  - TCP/IP for Embedded system M3S-T4-Tiny Module (r_t4) Rev.2.09 or higher
  - Embedded TCP/IP M3S-T4-Tiny Socket API Module (r_socket_rx) Rev.1.32 or higher
  - Interface Conversion Module for Ethernet Driver and Embedded system M3S-T4-Tiny (r_t4_driver_rx) Rev.1.08 or higher
- When command communication (UART) is used.
  - BYTEQ Module (r_byteq) Rev.1.81 or higher
  - DMAC Module (r_dmaca_rx) Rev.2.50 or higher
  - SCI Module (r_sci_rx) Rev.3.70 or higher

2.3   Supported Toolchain

This FIT module has been confirmed to work with the toolchain listed in 5.1 Confirmed Operation Environment.

2.4   Header Files

All API calls and their supporting interface definitions are in r_aeropoint_rx/include folder.

2.5   Integer Types

This driver uses ANSI C99. These types are defined in stdint.h

2.6   Configuration while Compiling

The configuration option settings of the Aeropoint FIT module are performed in cri_aero_rconfig_ais.h.
Please refer Aeropoint GUI User's Manual for details:

2.7   Adding the FIT Module to Your Project

The Aeropoint FIT module must be added to each project in which it is used. Renesas recommends the method using the Smart Configurator described in (1) below. However, the Smart Configurator only supports some RX devices. Please use the methods of (2) for RX devices that are not supported by the Smart Configurator.

(1)   Adding the FIT module to your project using the Smart Configurator in e^2 studio
By using the Smart Configurator in e^2 studio, the FIT module is automatically added to your project. Refer to the application note, "RX Smart Configurator User's Guide: e^2 studio (R20AN0451)" for details.

(2)   Adding the FIT module to your project using the FIT Configurator in e^2 studio
By using the FIT Configurator in e^2 studio, the FIT module is automatically added to your project. Refer to the application note, "RX Family Adding Firmware Integration Technology Modules to Projects (R01AN1723)" for details.

3. Pin Setting

The pin setting to use the Aeropoint FIT module can be performed with QE for Display [RX].

In case of e² studio, by using the pin setting function of the Aeropoint setting dialog of the QE for Display [RX], pin setting can be performed. When using the QE for Display [RX], pin setting regarding r_aeropoint_rx with Smart Configurator is not required.

Information of the selected pin is reflected in qe_aeropoint_config.h. Macro definition value shown in 2.6 Configuration while Compiling is overwritten according to the selected pin.

When performing the pin setting without using the QE for Display [RX], compile cri_aero_config_reference.h included in the Aeropoint FIT module and generate cri_aero_config_ais.h.

4.   Notation to implement the Aeropoint FIT module

When the Aeropoint FIT module is implemented, please note the following matters.

4.1   Selecting the library file

The Aeropoint FIT module includes following library files. Please refer the Aeropoint GUI User's Manual for detail and select the library correspond to the MCU and compiler.

Note: For the MCU which RXv3 core is installed, library files for RXv2 core can be selected. Although Smart Configurator is going to be able to select the library files with its dialog window, the function is not implemented in the recent version. Please set the library files when the using Smart Configurator does not have the function.

5.　Appendix

5.1　Confirmed Operation Environment

This section describes confirmed operation environment for the Aeropoint FIT module.

Table 5.1　Confirmed Operation Environment (Envision Kit)

Item	Contents
Integrated Development Environment	Renesas Electronics e^2 studio 2021-01
C compiler	Renesas Electronics C/C++ Compiler for RX Family(CC-RX) V3.02.00 Compile option： Add the option below to the default setting of the Integrated Development Environment. -lang = c99
Endian	Little endian
Version of the Module	Ver.1.00
Board used	Renesas Envision KIT RPBRX65N（Product No.：RTK5RX65N2C00000BR） Renesas Envision Kit RPBRX72N（Product No.：RTK5RX72N0C00000BJ）

Table 5.2　Confirmed Operation Environment (Renesas Starter Kit)

Item	Contents
Integrated Development Environment	Renesas Electronics e^2 studio 2021-01
C compiler	Renesas Electronics C/C++ Compiler for RX Family(CC-RX) V3.02.00 Compile option： Add the option below to the default setting of the Integrated Development Environment. -lang = c99
Endian	Little endian
Version of the Module	Ver.1.00
Board used	Renesas Starter Kit+ for RX72N（Product No.：RTK5572NNHS10000BE）

5.2　Troubleshooting

(1)　Q：I have added the FIT module to the project and built it. Then I got the error: Could not open source file "platform.h".

　　　A：The FIT module may not be added to the project properly. Check if the method for adding FIT modules is correct with the following documents:

- When using e^2 studio
  Application note "Adding Firmware Integration Technology Modules to Projects (R01AN1723)

  When using this FIT module, the board support package FIT module (BSP module) must also be added to the project. Refer to the application note "Board Support Package Module Using Firmware Integration Technology (R01AN1685)"

6. Reference Documents

User's manual: Software

・Aeropoint GUI User's Manual

User's manual: Hardware

・RX Family RX65N Group, RX651 Group User's Manual Hardware（R01UH0590）

（The latest version can be downloaded from the Renesas Electronics website.）

・RX Family RX72N Group User's Manual Hardware（R01UH0824）

（The latest version can be downloaded from the Renesas Electronics website. ）

Technical Update/Technical News

（The latest information can be downloaded from the Renesas Electronics website.）

User's Manual: Development Environment

RX Family C/C++ Compiler CC-RX User's Manual（R20UT3248）

（The latest version can be downloaded from the Renesas Electronics website.）

Related Technical Update

This module has no technical update.

Revision History

Rev.	Date	Description	
		Page	**Summary**
1.00	2021.3.16	-	First Release.

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

   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.

6. Voltage application waveform at input pin

   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.).

7. Prohibition of access to reserved addresses

   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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