RZ/A1H Group

Examples of Peripheral Function Settings and Its Usage (Initial Settings, DMAC, I^{2}C Bus, RSPI, SCIF, MTU2, and FLCTL)

Abstract

The application notes and the sample codes regarding the RZ/A1H initial settings and the following peripheral functions are put into one package. This application note describes the specifications of the packagelized sample code and its operation method.

- Direct memory access controller (DMAC)
- I^{2}C bus interface (RIIC)
- Renesas serial peripheral interface (RSPI)
- Serial communication interface with FIFO (SCIF) clock synchronous serial communication mode
- Multi-function timer pulse unit 2 (MTU2) PWM mode
- NAND flash memory controller (FLCTL)

Products

RZ/A1H

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

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1. Specifications

The RZ/A1H runs on the NOR flash memory connected to CS0 space in the Renesas Starter Kit+ for RZ/A1H and is initialized after the reset release. The sample cod information (version information etc.) is displayed to the terminal on the host PC which is connected by the serial interface, and the RZ/A1H waits until commands are input from the terminal. The sample codes to run the peripheral functions for DMAC, RIIC, RSPI, SCIF clock synchronous serial communication, MTU2, and FLCTL start when commands are input from the terminal.

Table 1.1 and Table 1.2 list the Peripheral Functions used in Sample Code and Their Outlines. Figure 1.1 shows the Operation Overview when the sample code is executed. Refer to respective application note for details about the sample code of each peripheral function.

Table 1.1 Peripheral Functions used in Sample Code and Their Outlines (1/2)

Sample Code	Outline
Example of initialization	Initialize the RZ/A1H, display the sample code information, and blink the LEDs on the Renesas Starter Kit+ for RZ/A1H every 500ms. Sample code start when commands are input from the terminal.
Direct memory access controller setting example	Transfer the data allocated to the large-capacity on-chip RAM space to the SDRAM space in CS2 by using DMA transfer.
I^2C bus interface EEPROM read/write example	Transmit/receive the data at the speed of 100kbps using the RZ/A1H as master device and the EEPROM as slave device.
Renesas serial peripheral interface EEPROM read/write example *	Transmit/receive the data at the speed of 2.78Mbps using the RZ/A1H as master device and the EEPROM as slave device.
Serial communication interface with FIFO Example of clock synchronous serial communication setting	Transmit/receive the data at the bit rate of 250kbps using the RZ/A1H loopback function.

Note: * EEPROM (R1EX25512ATA00) which corresponds to the SPI used in the sample code is not included in the Renesas Starter Kit+ for RZ/A1H. It should be prepared by customers.

Table 1.2 Peripheral Functions used in Sample Code and Their Outlines (2/2)

Sample Code	Outline
Waveform output by using PWM mode 1 of multi-function timer pulse unit 2	Output PWM waveforms according to the cycle and duty information prepared by the sample code.
Example of access to NAND-type flash memory using NAND flash memory controller *	Issue commands and control the NAND-type flash memory.

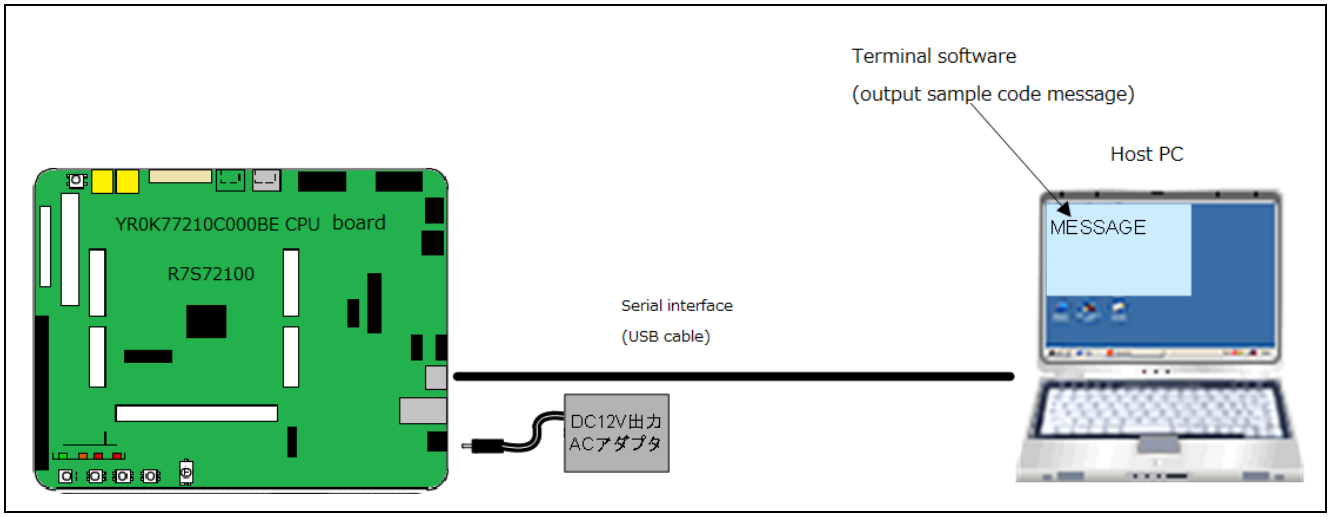

Figure 1.1 Operation Overview

2. Operation Confirmation Conditions

The sample code accompanying this application note has been run and confirmed under the conditions below.

Table 2.1 Operation Confirmation Conditions

Item	Contents
MCU used	RZ/A1H
Operating frequency *	CPU clock (Iϕ): 400 MHz Image processing clock (Gϕ): 266.67 MHz Internal bus clock (Bϕ): 133.33 MHz Peripheral clock 1 (P1ϕ): 66.67 MHz Peripheral clock 0 (P0ϕ): 33.33 MHz
Operating voltage	Power supply voltage (I/O): 3.3 V Power supply voltage (internal): 1.18 V
Integrated development environment	renesas integrated development environment e2 studio (Version: 7.4.0)
C compiler	GCC ARM Embedded(6.3.20170620)
	Compiler Option (excluding additional directory path) -mcpu=cortex-a9 -march=armv7-a -marm -mthumb-interwork -mlittle-endian -mfloat-abi=hard -mfpu=vfpv3 -Os -fsigned-char
Operating mode	Boot mode 0 (CS0 space 16-bit booting)
Terminal software communication settings	• Communication speed: 115200bps • Data length: 8 bits • Parity: None • Stop bit length: 1 bit • Flow control: None
Board used	Renesas Starter Kit+ for RZ/A1H • RTK772100BS00000BE
Device used	• NOR flash memory (Connected to CS0 spaces) Manufacturer: Spansion Inc. Product No.: S29GL512S • SDRAM (Connected to CS2 spaces) Manufacturer: Samsung Electronics Co., Ltd.. Product No.: K4S561632D • EEPROM Manufacturer: Renesas Electronics Corporation Product No.: R1EX24016AxxS0A • NAND flash memory (Connected to CS5 spaces) Manufacturer: Spansion Inc. Product No.: S34ML02G • Serial interface (USB connector) • LED1
	•

Note: * The operating frequency used in clock mode 0 (13.33MHz clock input on the EXTAL pin).

3. Reference Application Notes

For additional information associated with this document. The following application notes are including the project file of this application note, refer to them.

- RZ/A1H Group Example of Initialization (R01AN1864EJ)
- RZ/A1H Group Direct Memory Access Controller Setting Example (R01AN1703EJ)
- RZ/A1H Group I^2C Bus Interface
  EEPROM Read/Write Example (R01AN1760EJ)
- RZ/A1H Group Renesas Serial Peripheral Interface
  EEPROM Read/Write Example (R01AN1806EJ)
- RZ/A1H Group Serial Communication Interface with FIFO
  Example of Clock Synchronous Serial Communication Setting (R01AN1896EJ)
- RZ/A1H Group Multi-Function Timer Pulse Unit 2
  Waveform Output by Using PWM Mode 1 (R01AN1979EJ)
- RZ/A1H Group Example of Access to NAND-type Flash Memory
  Using NAND Flash Memory Controller (R01AN2000EJ)

4. Software

The sample code information (version information etc.) is displayed on the terminal after the RZ/A1H has been initialized, and the RZ/A1H waits until commands are input from the terminal. The sample code to run each peripheral function can start when commands are input from the terminal.

4.1 Running Sample Code

When the power is supplied to the Renesas Starter Kit+ for RZ/A1H, the message shown in Figure 4.1 is output. Ver.X.XX indicates the version for the main processing.

Display message

```
RZ/A1H CPU Board Sample Program. Ver.X.XX
Copyright (C) 2019 Renesas Electronics Corporation. All rights reserved.

select sample program.

SAMPLE>
```

Figure 4.1 Terminal Display when Sample Code Starts

4.2 Running Sample Code for Each Peripheral Function

The sample codes of peripheral functions (DMAC, RIIC, RSPI, SCIF clock synchronous serial communication, MTU2, and FLCTL) start when commands are input from the terminal.

Table 4.1 lists the Commands to Run Sample Code of Each Peripheral Function.

Table 4.1 Commands to Run Sample Code of Each Peripheral Function

Command	Sample Code
Input "DMAC" + "Enter" keys	DMAC setting example sample
Input "RIIC" + "Enter" keys	RIIC sample
Input "RSPI" + Enter" keys	RSPI sample
Input "SCIF_SYNC" + "Enter" keys	SCIF clock synchronous serial sample
Input "MTU2_PWM1" + "Enter" keys	MTU2 sample
Input "FLCTL" + "Enter" keys	FLCTL sample

For instance, to run the sample code of DMAC setting example, input "DMAC" + "Enter" keys subsequent to "SAMPLE>" prompt ([1] in Figure 4.2). Then the message for starting the sample code of DMAC setting example is output shown as [2] in Figure 4.2. Ver.Y.YY indicates the version of sample code for each peripheral function.

Refer to the application note for each peripheral function regarding supported commands after its sample code has been started.

Display messages

```
RZ/A1H CPU Board Sample Program. Ver.X.XX                                    [1]
Copyright (C) 2019 Renesas Electronics Corporation. All rights reserved.

select sample program.

SAMPLE> DMAC
```

```
RZ/A1H DMAC Sample Program. Ver.Y.YY                                         [2]
Copyright (C) 2019 Renesas Electronics Corporation. All rights reserved.

select sample program.

DMAC SAMPLE>
```

Figure 4.2 Example of Terminal Display when Sample Code of DMAC Setting Example Starts

5. Sample Code

Sample code can be downloaded from the Renesas Electronics website.

6. Reference Documents

User's Manual: Hardware

RZ/A1H Group User's Manual: Hardware
The latest version can be downloaded from the Renesas Electronics website.

Renesas Starter Kit+ for RZ/A1H User's Manual
The latest version can be downloaded from the Renesas Electronics website.

RZ/A1H Group Renesas Starter Kit+ Tutorial Manual For e2 studio
The latest version can be downloaded from the Renesas Electronics website.

ARM Generic Interrupt Controller Architecture Specification Architecture version 1.0
The latest version can be downloaded from the ARM website.

ARM Cortex™-A9 (Revision: r3p0) Technical Reference Manual
The latest version can be downloaded from the ARM website.

ARM CoreLink™ Level 2 Cache Controller L2C-310 (Revision: r3p2) Technical Reference Manual
The latest version can be downloaded from the ARM website.

Technical Update/Technical News

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

Website and Support

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Revision History

Rev.	Date	Description	
		Page	Summary
Rev.1.00	Jul. 11, 2014	–	First edition issued
Rev.1.01	Aug. 29, 2014	1,3,4,6,7	Add the application note and the sample code of multi-function timer pulse unit 2 (MTU2)
Rev.1.02	Oct. 03, 2014	1,3,4,6,7	Add the application note and the sample code of NAND flash memory controller (FLCTL)
Rev.1.03	Aug. 28, 2015	–	Update both the following application notes and sample codes • Example of Initialization (Updates from Rev.1.00 to Rev.1.01) • Direct Memory Access Controller Setting Example (Updates from Rev.1.00 to Rev.1.01) • I^2C Bus Interface EEPROM Read/Write Example (Updates from Rev.1.00 to Rev.1.01) • Example of Using USB 2.0 Host/Function – USB Host Mass Storage – (Updates from Rev.0.80 to Rev.1.00) • Example of Using USB 2.0 Host/Function – USB Function – (Updates from Rev.0.80 to Rev.1.00)
Rev.1.04	Apr. 24, 2020	–	Update both the following application notes and sample codes • Serial Communication Interface with FIFO Example of Clock Synchronous Serial Communication Setting (Updates from Rev.0.80 to Rev.1.00) • Multi-Function Timer Pulse Unit 2 Waveform Output by Using PWM Mode 1 (Updates from Rev.0.81 to Rev.1.00) • Example of Access to NAND-type Flash Memory Using NAND Flash Memory Controller (Updates from Rev.0.80 to Rev.1.00) The following application note updates just the contents of the document without updating the sample code. • Renesas Serial Peripheral Interface EEPROM Read/Write Example (Updates from Rev.1.00 to Rev.1.01)
Rev.1.05	Apr. 24, 2020	–	• Delete description for USB according to removing of the USB-related following application notes and sample code. • RZ/A1H Group Example of Using USB 2.0 Host/Function - USB Host Mass Storage - RZ/A1H Group Example of Using USB 2.0 Host/Function – USB Function -
Rev.2.00	Apr. 24, 2020	–	• Change IDE to e2 studio • Change C compiler to GCC ARM Embedded • Change Board used to Renesas Starter Kit+for RZ/A1H
Rev.2.01	Jan. 27, 2021	–	• Modified redundant processing.
Rev.2.02	Mar. 27, 2023	–	• Add driver(VDC5,DVDEC,CEU,SSIF)
Rev.2.03	Mar. 31, 2026	Sample Program / Driver	• Update to handling of INTC.IRQRR

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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(Rev.5.0-1 October 2020)

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