RZ/A1H Group

RZ/A1H Software Package Quick Start Guide

1. Introduction

This is the Quick Start Guide for the RZ/A1H Software Package which runs on the Renesas Starter Kit + for RZ/A1H, and the operation of Renesas e^2 studio.

The sample code in this software package can be used as the starting point for developing your own applications.

Table 1. All Samples of this package

Name	Description
GUI Sample	Very simple application which uses the 'Guiliani' GUI library. This sample application gets and sets data in a GUI.
SDK for Camera Sample	Displays the image from the attached camera and allows several image adjustments (for example brightness and contrast).
Touch Panel Sample	Detects a touch event and draws a cursor using JPEG decode.
Web Server Sample	The target board operates as a web server. You can control the LED and view the directory listing of any USB Mass Storage devices via a web browser on your PC.
USB Host Sample	Implements Mass Storage Class access via a file system accessed using commands in a console. Also implements HID class (mouse / keyboard).
USB Function Sample	HID class (mouse / keyboard) and CDC class are available.
ADC Sample	Monitor the voltage read from the on-board potentiometer.
Sound Sample (play / record)	'Play' demonstrates playing a fixed sound that is hard-coded in the sample code. 'Record' plays the sound present on the microphone input in real time.

List of Abbreviations and Acronyms

Table 2. List of Abbreviations and Acronyms

Abbreviation	Full Form
ADC	Analogue to Digital Converter
API	Application Programming Interface
ARM	Advanced RISC Machines
CDC	Communications Device Class
COM	COMmunications
DHCP	Dynamic Host Configuration Protocol
DTR	Data Terminal Ready
EEPROM	Electrically Erasable Programmable Read-Only Memory
FAT	File Allocation Table
GCC	GNU Compiler Collection
GSE	Guiliani Stream Editor
GUI	Graphical User Interface
HID	Human Interface Device
HMI	Human Machine Interface
H/W	HardWare
IAR	IAR Systems (https://www.iar.com)
I/O	Input/Output
IP	Internet Protocol
JTAG	Joint Test Action Group
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MAC	Media Access Control
PC	Personal Computer
QSG	Quick Start Guide
QSPI	Quad Serial Peripheral Interface
RAM	Random Access Memory
RTOS	Real Time Operating System
RTS	Request To Send
SDK	Software Development Kit
TES	TES Electronic Solutions
TFT	Thin Film Transistor
URL	Uniform Resource Locator
USB	Universal Serial Bus
WDT	WatchDog Timer
WYSIWYG	What You See Is What You get

2. Preparation

Please check your board settings by referring the Renesas Starter Kit + User's Manual for e² studio (R20UT3007EG).

2.1 Tool

The RZ/A1H Software Package can be used in the following environment. Please check your environment before continuing.

Tools:

e² studio (free of charge)

- IDE: e² studio v2023-10 or later
- Tool Chain: GNU Arm Embedded Toolchain: 9-2020-q2-update
  Available from https://developer.arm.com/open-source/gnu-toolchain/gnu-rm

JLink drivers (free of charge) v6.12n or later

JLink drivers need to be installed whether using e² studio or IAR Embedded Workbench.

Available from https://www.segger.com/downloads/jlink/

Target Board:

Product code: RENESAS STARTER KIT + FOR RZ/A1H

Bootloader:

This package includes a bootloader as a binary file. To get the source code, download from the following URL:

https://www.renesas.com/sg/en/products/software-tools/boards-and-kits/starter-kits/renesas-starter-kitplus-for-rz-a1h.html#productInfo

The Segger J-Link LITE included in the evaluation kit is dedicated to the attached evaluation board. This J-Link LITE cannot be used for any other boards or products.

2.2 Virtual Serial Port Connection

Connect a mini USB cable between CN18 on the Renesas Starter Kit + for RZ/A1H and a Windows™ PC, this provides a USB virtual serial port.

When the Renesas Starter Kit + for RZ/A1H is first connected the PC will look for a suitable driver. This driver is installed during the installation process, and your PC should automatically find and install it. It will report that it is installing a driver and then that the driver has been installed successfully. The COMx port number allocated to the virtual serial port can be found in Window™ Device Manager.

2.3 Serial Terminal

Start a serial terminal program (such as PuTTY, HyperTerminal or Tera Term) using the configuration below:

- Baud Rate: 115,200
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None
- COM Port: As shown in Windows™ Device Manager

3. Running the RZ/A1H Software Package GUI Sample

The GUI sample is an application that demonstrates interfacing hardware with the Guiliani library. This sample provides functions for controlling a LED from the GUI, and displaying the output from a real time clock on the GUI. In other words, this sample shows bidirectional control between the hardware and GUI.

The figure below shows the screen image from the GUI displayed on the Renesas Starter Kit + for RZ/A1H board.

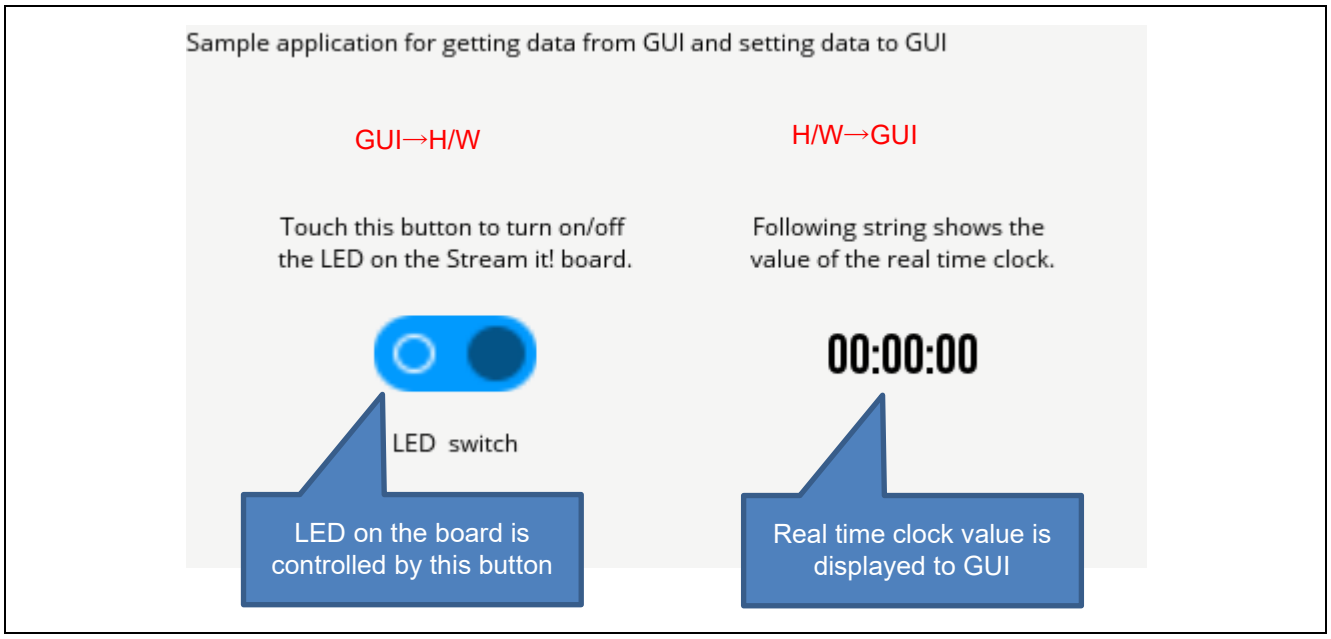


Figure 1. The image displayed on the board

Step through the following sequence to run this sample application.

3.1 Downloading the GUI Sample Resource File to the Target Board

Make sure the GUI resource file for the 'GUI Sample' sample is downloaded before running this sample. Otherwise, the sample will not work.

- Attach the J-Link LITE ARM to the target board and PC.
- Ensure that the Renesas Starter Kit + for RZ/A1H TFT LCD's connector (CN32) is connected to the Renesas Starter Kit + for RZ/A1H board's LCD connector (CN44)
- Connect a mini USB cable between your PC and connector CN18 to power the target.
- Launch `RZ/A1H_Sample\src\tes\FlashTools\FlashGuilianiDemo.bat`.

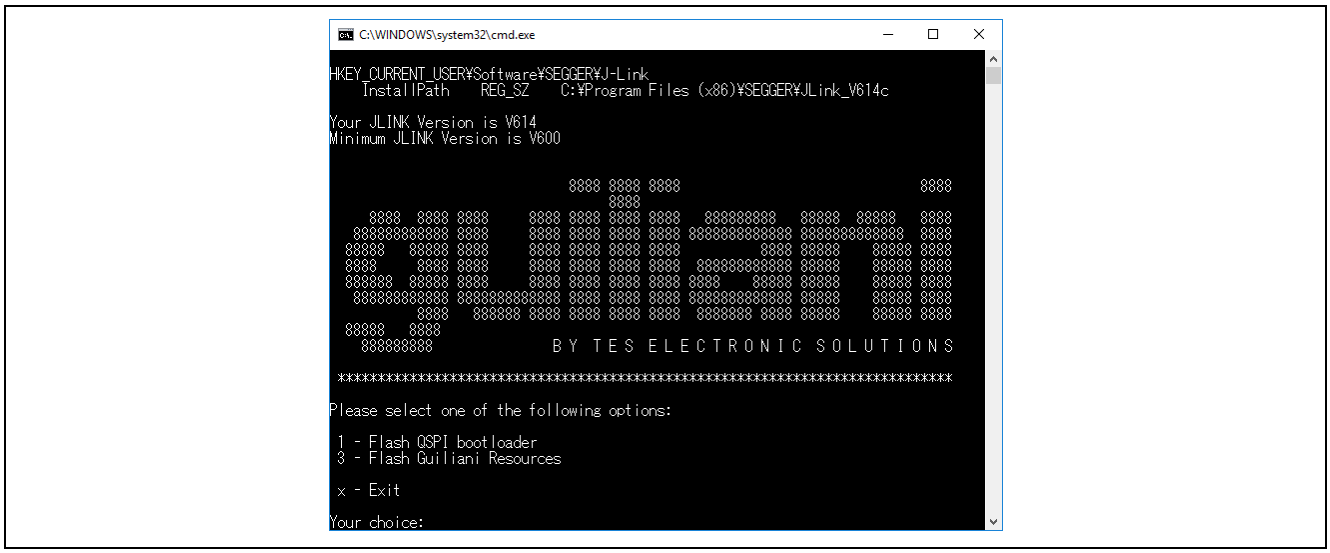
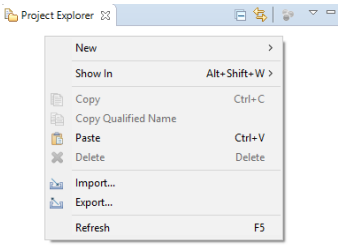


Figure 2. Application to flash GUI sample application (has menu options 1 and 3 only)

- Type '3[enter]' to flash the Guiliani resources.
- Type '2[enter]' to select the Renesas Starter Kit + for RZ/A1H board.
- Once the flash process has completed, press any key to return to the main menu.

3.2 Importing the Software Package into the IDE



- The software package is distributed as an archive file. The build project for this software package can be imported into e^2 studio from the **Project Import** menu.
- Launch e^2 studio from the start menu.
- Set the 'RZA1_SoftwarePackage' directory which has 'RZ/A1H_Sample' sub-directory for the workspace directory.
- In the e^2 studio welcome screen, click **workbench**.
- Right-click in the **Project Explorer** window and select **Import**.
- Under **Import Source** select **General → Existing Projects into Workspace** and click **Next**.
- Select **Browse** to the right of **Select root directory**, and the **Browse For Folder** dialog box will appear.
- Press **OK**.
- Ensure the 'RZ/A1H_Sample' project is selected, then click **Finish**.

3.3 Build and Download to Target Board

- For a new board, you will need to program the boot loader application. This will only need to be done once. To do this, execute the batch file `Program_RZ_A1H_boot.bat` which can be found in the folder `RZ/A1H_Sample\util\dos_scripts`.

When using e^2 studio and the GCC toolchain:

- Select the 'RZ/A1H_Sample' project with a left click, then click the arrow next to the (build) button and select **HardwareDebug** from the drop-down menu.

- e^2 studio will now build the project (see note).
- Once this is complete, debugging can be started by clicking on the (debug) button.

- e^2 studio may ask you to confirm the perspective switch. Click **Yes**.
- Once the code has been downloaded, click the (resume) button to run the code.

Note: Please chose a workspace path that is not too long. Long paths can cause build errors.

3.4 Launching the GUI Sample

After running the sample code, the serial terminal will show the welcome banner. The GUI Sample will run after typing ‘gui’ folowed by [enter] on the command console.

For more details of this sample, please refer to the GUI Sample Program Application Note (R01AN5097).

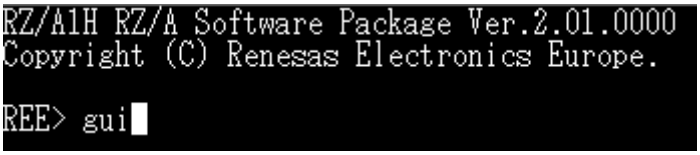


Figure 3. Command to launch the GUI Sample

4. Running another Sample Application

You can set enable or disable for each sample application by editing the definitions in the configuration file `application_cfg.h`. This file is located in `RZ/A1H_Sample\src\renesas\configuration`. Note that after making changes to `application_cfg.h`, you will need to rebuild and then download the code to reflect your chosen applications. Please bear in mind that not every application can be concurrently enabled due to target board specification and memory size limitations. If a sample application is enabled, its operation can be controlled via a terminal console as shown in section 3.4. All available commands are shown in the following tables.

Table 3. Console Commands (1 / 3)

Command Type	Command	Description
General Commands	date DD/MM/YYYY <CR>	Set the date
	time hh:mm:ss <CR>	Set the time
	mem a l <CR>	Reads memory from address H'a length H'l
	drivers <CR>	List driver table. Note that drivers may not be loaded
	handles <CR>	List opened driver information
	ver <CR>	Show the application version
Platform Commands	mperf <CR>	Check the speed of writing to RAM
	led a s <CR>	Sets LED a state to on (s = 1), off (s = 0), toggle (s = ^)
	restart <CR>	Restart the system with a WDT reset
	logout <CR>	Exit a login shell
	sys <CR>	Shows the system resource usage information
	task <CR>	List tasks
	help <CR>	Show the help screen
Touchscreen Commands (refer to section 4.6)	tsdemo <CR>	Run the touch screen demo
Camera SDK Commands (refer to section 4.5)	sdk <CR>	Run the SDK for camera demo (requires screen and camera modules)
ADC Application Commands (refer to section 4.7)	adcdemo <CR>	Run the ADC application demo
USB HID class Mouse Commands (refer to section 4.4)	hidmouse <CR>	Provides HID mouse implementation, follow on screen instructions
USB CDC class (refer to section 4.4)	cdcconsole <CR>	Run CDC console, requires a terminal program
Sound Application Commands (refer to section 5.8)	play <CR>	Run the play sound application
	record <CR>	Run the record sound application
GUI Commands	gui <CR>	Run the GUI sample

Table 4. Console Commands (2 / 3)

Command Type	Command	Description
USB Commands	usbm <CR>	Monitors the data from a USB mouse
	usbk <CR>	Invokes a USB console reading data from a USB keyboard
USB Mass Storage Commands (*) (refer to section 4.3)	vol <CR>	Volume information for the working drive
	type f <CR>	Write text file f to the console
	copy s d <CR>	Copy file ‘s’ to destination ‘d’
	view f <CR>	View contents of file ‘f’
	dir <CR>	List the working directory
	pwd <CR>	Print the working directory
	cd d <CR>	Change working directory to ‘d’
	del f <CR>	Delete file ‘f’
	md n <CR>	Make ‘n’ in the working directory
	rd d <CR>	Delete directory ‘d’
	ren s d <CR>	Rename / move file ‘s’ to ‘d’
	disk <CR>	List the available disk drives
	eject d <CR>	Eject disk ‘d’
	dismount <CR>	Dismount all mounted drives
	mount <CR>	Mount all Mass Storage devices
USB MS Test Commands	rperf f <CR>	Read file performance test
	wrperf f <CR>	Write file performance test
USB CDC Serial Port Commands	sopen <CR>	Opens a CDC device
	sclose <CR>	Closes an open CDC device
	sctltst <CR>	Perform control API tests for the CDC driver
	sttx n <CR>	Transmit n kbytes of data through the CDC device
	sloop <CR>	Loops-back received characters through the CDC device
	sbaud n <CR>	Set the baud rate to n
	scontrol n <CR>	Assert / Deassert RTS / DTR control signals n = 1 or 0
	sparity p <CR>	Sets the parity to N = none, E = Even, O = Odd
	sstop s <CR>	Sets the number of stop bits 1, 1.5 or 2
	sline <CR>	Returns the line status
	sbreak <CR>	Sets / clears the break signal
	stest s <CR>	Test all CDC driver functions with a loop-back connector
	sloopall <CR>	Loop-back test on maximum of 4 CDC devices (default baud rate)

*Note: After connecting USB MSC devices, enter a drive letter such as ‘A:[Enter]’ before using any of the USB mass storage commands. Please refer to section 4.3.

Table 5. Console Commands (3 / 3)

Command Type	Command	Description
Ethernet Platform Commands (refer to section 4.2)	readrom <CR>	Read the EEPROM
	rstrom <CR>	Reset all user data in the EEPROM
	ipconfig -o <CR>	Where o is one of the or more following options: -r = Reset to default settings -s = Save current settings -i:xxx.xxx.xxx.xxx = Set IP address -m:xxx.xxx.xxx.xxx = Set IP address mask -g:xxx.xxx.xxx.xxx = Set DHCP server gateway address -on = Enable DHCP -off = Disable DHCP -all = Display current settings (no option) = Command list display
	ifconfig -o <CR>	Where o is one of the above options
	setmacaddress -o <CR>	Where o is one of the following options -a:xx:xx:xx:xx:xx:xx = Set MAC address and save -s = Save current settings (no option) = Command list display

4.1 General Functionality

- The serial terminal will show the welcome banner.
- Type '?'<CR> on the serial terminal to show a list of all available commands.
- All commands are invoked once <CR> is pressed after entering the command. This is not shown again in this document.

4.2 Web Server Sample

In `application_cfg.h` the two definitions 'R_SELF_LOAD_MIDDLEWARE_ETHERNET_MODULES' and 'R_SELF_LOAD_MIDDLEWARE_USB_HOST_CONTROLLER' should both be set to R_OPTION_ENABLE when using this sample.

Please step through the following procedure to use this application.

4.2.1 Setting MAC Address

This step only needs to be performed once; the MAC address will be saved to non-volatile EEPROM.

To enable Ethernet type the command 'netstart', to disable Ethernet type 'netstop' and press Return.

- The target board has a sticker showing a unique MAC address. This needs to be written to the EEPROM by entering the command: 'setmacaddress –a:xx:xx:xx:xx:xx:xx -s', where xx is the address shown on the MAC address sticker.
- The serial terminal will show the welcome banner.

4.2.2 Ethernet Functionality

- IP address configuration depends on whether a static IP address is to be used, or if it's going to be assigned by a DHCP server:

Table 6. DHCP and Static IP Configuration

DHCP Configured	Static IP Configuration
a) Type 'ipconfig -on -s' to enable DHCP and save settings to EEPROM.	a) Type the following on a single line: ipconfig -i:`ip-address` -m:`subnet-mask` -g:`gateway-address` -off -s Where `addresses` and `masks` are in the format xxx.xxx.xxx.xxx for example: 192.168.172.123.
b) Connect the Ethernet cable to CN6. The serial console will display the allocated `ip-address`.	b) Connect the Ethernet cable to CN6.

- On the remote PC launch a web browser and enter the following in to the address bar:
  http://ip-address
  Where ip-address is the address used or allocated in the step above.
- The web browser will display web pages for the demonstration loaded from the target board.

4.2.3 Web Pages

- The landing web page shows an image of the target board and information about the demonstration. On the left there is a check box which controls the target board user LED.
- The second tab (**Mass Storage**) shows the directory listing of any USB Mass Storage devices inserted into the target board. Clicking on a file name will open it in the PC web browser.
- On the left is a USB read / write speed test facility. The drive and test file size are selected from the drop down and the test started by clicking **Test**.

  Note: Due to limitations of some USB Mass Storage Class Devices, very large test sizes may not work as expected.

- The final tab (**Administration**) demonstrates a simple secure webpage implemented on the target board. The sample is not intended to be a truly secure solution, only an example. The default login credentials are: Username: ‘admin’, Password: ‘password’. These can both be changed on the **Administration** page or via the serial terminal.
- The Software Package web server can support many simultaneous connections over Ethernet.

4.3 USB Host Sample

The definition ‘R_SELF_LOAD_MIDDLEWARE_USB_HOST_CONTROLLER’ in the `application_cfg.h` configuration file should be set to R_OPTION_ENABLE in order to use this sample.

Ensure that ‘R_SELF_INSERT_APP_HID_MOUSE’ and ‘R_SELF_INSERT_APP_CDC_SERIAL_PORT’ are both set to R_OPTION_DISABLE.

Multiple USB devices may be connected to the Renesas Starter Kit + for RZ/A1H using a USB hub with four ports or less (single tier). To provide sufficient power for all devices the hub must be externally powered. For this QSG only one device will be used at a time and inserted directly in to Renesas Starter Kit + for RZ/A1H.

Please step through the following procedure to use this application:

- Insert a FAT formatted Mass Storage Device (USB memory stick, hard drive, etc.) into CN9.
- Type ‘drivers’ - details of the USB device will be shown.
- Type 'a:' - the prompt changes to confirm the drive change.
- Type ‘dir’ - a directory listing of the drive will be shown.
- Type ‘?’ to see the available commands for file and folder manipulation.
- Remove the Mass Storage Device from CN9 ready for the next demonstration.

4.4 USB Function Sample

The definitions ‘R_SELF_INSERT_APP_CDC_SERIAL_PORT’ and ‘R_SELF_INSERT_APP_HID_MOUSE’ in the configuration file `application_cfg.h` should be set to enable in order to use this application.

Ensure that the define ‘R_SELF_LOAD_MIDDLEWARE_USB_HOST_CONTROLLER’ is disabled by setting it to R_OPTION_DISABLE.

Please follow the steps below to use this application:

4.4.1 USB CDC Functionality

- Connect a USB host to USB host cable from the PC to the Renesas Starter Kit + for RZ/A1H via CN6.
- Use the ‘cdcconsole’ command to bring up the CDC functionality.
- Follow the instructions on the debug terminal.
- Using the host PC’s Device Manager, confirm that a new COM port is added when the ‘cdcconsole’ command is running.
- Ensure that another serial terminal program is configured and press any key on the first serial terminal program.
- Connect your second terminal to the virtual COM port.
- The ‘cdcconsole’ application will echo what is typed on the virtual console.

4.4.2 USB HID Mouse Functionality

- Use the ‘hidmouse’ command to bring up the mouse functionality.
- Again the ‘?’ command shows the available commands for this functionality.
- To move the PC mouse, use the command ‘movexy’ followed by a desired x and y coordinate.
- Use ‘button1’ and ‘button2’ for the left and right click, respectively.
- To end the session, use the ‘logout’ command.

4.5 SDK for Camera Sample

The definition 'R_SELF_INSERT_APP_SDK_CAMERA' in the configuration file `application_cfg.h` should be set to R_OPTION_ENABLE in order to use this application.

Please follow the steps below to use this application:

- Type 'sdk' <CR> on the serial terminal to view available commands.
- The SDK for Camera application will be launched.
- Several image adjustments can be made. Please refer to the SDK for Camera Application Note (R01AN5094).

4.6 Touch Panel Sample

The definition 'R_SELF_INSERT_APP_TOUCH_SCREEN' in the configuration file `application_cfg.h` should be set to R_OPTION_ENABLE in order to use this application.

Please follow the steps below to use this application:

- Type 'tsdemo' <CR> on the serial terminal to view available commands.
- The Touch Panel application will be launched.
- The application will detect a touch event and draw a small green rectangle at the coordinates of the event. Please refer to the Touch Panel Utility Application Note (R01AN5096).

4.7 ADC Sample

The definition 'R_SELF_INSERT_APP_ADC' in the configuration file `application_cfg.h` should be set to R_OPTION_ENABLE in order to use this application.

Please follow the steps below to use this application:

- Type 'adcdemo' <CR> on the serial terminal to execute the ADC functionality.
- The terminal will then display the voltage read on AN7.
- To change the value, turn the variable resistor RV1.
- To end the session, press any key.

4.8 Sound Sample

The definition 'R_SELF_INSERT_APP_SOUND' in the configuration file `application_cfg.h` should be set to R_OPTION_ENABLE in order to use this application.

Please follow the steps below to use this application:

- Plug in a headphone to connector CN20', and line-in jack to connector CN19.
- Type 'play' <CR> on the serial terminal to execute the sound functionality.
- Sound will play in the left and right channels.
- Type 'record' to listen to the line-in input.

4.9 GUI Sample

The definition 'R_SELF_INSERT_APP_GUI' in the configuration file `application_cfg.h` should be set to R_OPTION_ENABLE in order to use this application.

Please refer to section 3 to use this application.

5. Tips

5.1 Using un-cached internal RAM

5.1.1 Allocating a variable to un-cached internal RAM

To allocate a variable to un-cached internal RAM, add the following string after the declaration of the variable:

```
int foo __attribute__((section(".VRAM_SECTION0"));
```

5.1.2 Changing the size of un-cached internal RAM

To increase the size of un-cached interna RAM, open `src\renesas\compiler\linker_settings.ld` and increase the value of `VRAM_LENGTH`. And reduce the value of `RAM_LENGTH` by the same value you increased for the value of `VRAM_LENGTH`.

From ld File

```
VRAM_END    = 0x20A00000;
VRAM_LENGTH = 0x200000;
VRAM_START  = VRAM_END - VRAM_LENGTH;
```

5.1.3 Using Mirror memory

RZ/A1H has the mirror memory. If you modified `src\renesas\compiler\linker_settings.ld` to use the mirror memoryIf desired, modify src\renesas\compiler\asm\ttb_init.S to specify the attribute of the memory.

In ld file simply setting should swap from non-Mirrored to Mirrored RAM select only 1

```
#VRAM_END    = 0x20A00000;                    # Normal RAM
VRAM_END    = 0x60A00000;                     # Mirrored RAM
VRAM_LENGTH = 0x200000;
VRAM_START  = VRAM_END - VRAM_LENGTH;
```

In ttb_init.S where

```
/* ---- Parameter setting to level1 descriptor (bits 19:0) ---- */
/* Strongly-ordered memory
    B-00000000000000000000110111100010 */
    .equ TTB_PARA_STRGLY , 0x0DE2
/* Outer and inner not cache normal memory
    B-00000000000000000001110111100010 */
    .equ TTB_PARA_NORMAL_NOT_CACHE , 0x1DE2
/* Outer and inner write back, write allocate normal memory (Cacheable)
    B-00000000000000000001110111101110 */
    .equ TTB_PARA_NORMAL_CACHE , 0x1DEE


    .equ M_SIZE_RAM_M , 10     /* [Area11] Internal RAM (mirror) */
```

Modify the attribute

```
setting_area11:                          ;
  LDR  r3, =M_SIZE_RAM_M
  LDR  r4, =TTB_PARA_NORMAL_NOT_CACHE
  BAL  init_counter
```

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Nov.29. 2019	-	First Edition issued
1.10	Oct. 11. 2021	-	Updated toolchain Ensured document inline with current QSG template
1.20	Jul. 20. 2022	16	Added section 5 Tips.
1.31	Nov. 24. 2023	3	Updated the version of e2 studio.

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.

Notice

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(Rev.5.0-1 October 2020)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

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