

# RX Family

R20AN0037EJ0304

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Sound Playback/Compression System (Original ADPCM Codec)

[M3S-S2-Tiny] Module

Firmware Integration Technology

## Introduction

This application note explains how to implement the ADPCM Encoder/Decoder Library using Firmware Integration Technology(FIT). S2 Library can playback/record to use RX Family. The S2 library for the Renesas Microcomputer is written in optimized assembler.

S2 Library has translation tool from sound data (WAVE file) to ADPCM compressed sound data for microcomputer.

Please refer to the application note “r20an0291ej0101\_rx\_s2.pdf” for the each of Renesas Starter Kit.

## Target Device

RX Family

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## 1. Outline

ADPCM(adaptive differential pulse code modulation) is one of the way to recode voice. This has constant period sampling to get voice data, and expects "Difference" from previous input to next input, and recodes this "Difference". ADPCM data is smaller than general PCM data for one sample. ADPCM is recommended for embedded microcomputer having small memory.

S2 library encodes 16bit PCM data and outputs to 4bit ADPCM data. And S2 library decodes 4bit ADPCM data and output 16bit PCM data

### 1.1 S2 library

S2 Library has the following Libraries.

<b>S2 library</b>	<b>Outline</b>
s2_rx600_little_rtune.lib	S2 library for RX600 little endian assembler tuning ver.(*2)
s2_rx600_big_rtune.lib	S2 library for RX600 big endian assembler tuning ver.(*2)
s2_rx200_little_rtune.lib	S2 library for RX200 little endian assembler tuning ver.(*1)
s2_rx200_big_rtune.lib	S2 library for RX200 big endian assembler tuning ver.(*1)

(\*1)RX200 Library can be used as a RX100 Library.

(\*2)RX600 Library can be used as a RX700 Library.

## 1.2 S2 Library ROM / RAM / stack size

This section explains S2 Library performance and memory usage.

### 1.2.1 ROM/RAM/Stack size

— S2 library for the RX Family assembler tuning version.

ROM       : about 800       byte  
 RAM       :           0       byte (Upper layer program needs about 30byte for work area.)

API	Stack size
R_adpcm_initEnc	4
R_adpcm_refreshEnc	4
R_adpcm_encode	12
R_adpcm_initDec	4
R_adpcm_refreshDec	4
R_adpcm_decode	24

### 1.2.2 Speed (reference value)

Assembler tuning version for RX Family

API	Operarion Cycle	
	Sample=4(*)	Sample=16(*)
R_adpcm_initEnc	10	10
R_adpcm_refreshEnc	10	10
R_adpcm_encode	260	1000
R_adpcm_initDec	10	10
R_adpcm_refreshDec	10	10
R_adpcm_decode	210	770

The value that is specified to first argument of the functions (R\_adpcm\_encode, R\_adpcm\_decode)

### 1.3    Version information

User can access S2 Library information with valuable below.

```
extern const mw_version_t R_s2_version;
```

RX600(little endian) Library file:

"M3S-S2-Tiny version 3.04 for RX600 LITTLE endian.(Feb 19 2016, 15:43:05)"

RX600(big endian) Library file:

"M3S-S2-Tiny version 3.04 for RX600 BIG endian.(Feb 19 2016, 15:43:32)"

RX200(little endian) Library file:

"M3S-S2-Tiny version 3.04 for RX200 LITTLE endian.(Feb 19 2016, 15:44:09)"

RX200(big endian) Library file:

"M3S-S2-Tiny version 3.04 for RX200 BIG endian.(Feb 19 2016, 15:44:18)"

## 2. API Information

### 2.1 Hardware Requirements

None.

### 2.2 Software Requirements

None.

### 2.3 Supported Toolchains

This library is tested and working with following toolchains:

    Renesas RX Toolchain V2.04.01

### 2.4 Limitations

This library can be used with Microcontroller Options `fint_register=0` (Fast interrupt vectorregister [None]). The default for this option is `fint_register=0`.

### 2.5 Header Files

All API calls are accessed by including a single file "r\_adpcm.h" which is supplied with this software's project code.

Build-time configuration options are selected or defined in the file "r\_s2\_rx\_config.h"

### 2.6 Configuration Overview

All configurable options that can be set at build time are located in the file "r\_s2\_rx\_config.h".

There is no configuration option.

### 2.7 Adding Library to Your Project

Please refer to the Adding Firmware Integration Technology Modules to Projects "r01an1723eu0111\_rx.pdf" (for e<sup>2</sup> studio) or "r01an1826ej0102\_rx.pdf" (for CS+).

Lib folder has all S2 Libraries for RX Family. If user implements using the scheme that is explained in this document, all S2 Libraries will be linked for building. Please remove the Libraries excluding your needing libraries.

### 3. API(Library) Functions

S2 Library uses the following APIs.

API	Outline
R_adpcm_initEnc	The function is initialization function for encode process.
R_adpcm_refreshEnc	The function sets temporary area for encoding.
R_adpcm_encode	The function will encode 16bit PCM data to 4bit ADPCM data (compression).
R_adpcm_initDec	The function is initialization function for decoding.
R_adpcm_refreshDec	The function sets temporary area for decoding.
R_adpcm_decode	The function will decode 4bit ADPCM data to 16bit PCM data (de-compression).

Please refer to the User's Manual if you needs details. (r20uw0079ej0100\_s2.pdf)

### 4. Library version information

Ver	change
3.04	Updated version number with the xml file revision.
3.03	Updated version number.
3.02	Updated version number.
3.01	Fixed decode function bug.
1.00	First release

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## Revision History

Rev.	Date	Description	
		Page	Summary
3.04	Apr 01, 2016	—	Corresponded to RX Family. Updated the xml file for FIT.
3.03	Mar 01, 2015	—	Corresponded to RX231. Updated the xml file for FIT.
3.02	Dec 28, 2014	—	Corresponded to RX71M/RX113. Updated the xml file for FIT.
3.01	Apr 01, 2014	—	First edition issued

## 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. 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 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. Unused pins should be handled as described under Handling of Unused Pins in the manual.

### 2. Processing at Power-on

The state of the product is undefined at the moment 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 moment 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 moment 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 moment when power is supplied until the power reaches the level at which resetting has been specified.

### 3. Prohibition of Access to Reserved Addresses

Access to reserved addresses is prohibited.

- The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

### 4. Clock Signals

After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has 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. Moreover, 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.

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Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

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