RL78/F Series

RSA Library: Installation Guide

Introduction

This document explains RSA Library for the RL78/F Series.

The RSA library is a software library for digital signature processing using private and public keys and exponentiation processing for RL78/F Series.

Please refer to the User's Manual (R20UW0175) to know how to use this software library.

Target Device

RL78/F Series

Contents

1. Structure of product

Table 1. RSA Library product files

Name	Description
r20an0690ej0101-rl78-fx-rsa <DIR>	
readme-e.txt	Package Structure, Release Note (English)
readme-j.txt	Package Structure, Release Note (Japanese)
Document <DIR>	
r20an0690ej0101-rl78-fx-rsa.pdf	RSA Library Installation Guide (this document)
En	
r20uw0175ej0101-rl78-fx-rsa.pdf	RSA Library User's Manual (English)
Ja	
r20uw0175jj0101-rl78-fx-rsa.pdf	RSA Library User's Manual (Japanese)
Workspace <DIR>	
libsrc <DIR>	Library folder
rsa <DIR>	RSA Library folder
src <DIR>	RSA Library source folder
r_rsa_api.c	RSA Library API function
r_mc_lib.c	RSA Arbitrary Length Integer Calculation library source file
r_mc_lib.h	RSA Arbitrary Length Integer Calculation library header file
r_rsa_internal_header.h	RSA Library API function internal header file
r_rsa_version.c	RSA Livrary version file
include <DIR>	RSA Library header folder
r_rsa.h	RSA Library header file
r_mw_version.h	Version data header file
r_stdint.h	Typedef header file
sha <DIR>	Folder for storing SHA Library (Store Sample SHA library)
CS+ <DIR>	CS+ project folder
rl78_rsa_library_sample <DIR>	Sample project for F24
src<DIR>	Main function folder
main.c	Sample code source file
main.h	Sample code header file
r_sample_key.c	RSA Key sample source file
r_sample_key.h	RSA Key sample header file
r_sample_modexp.c	RSA Modular exponentiation sample program
r_sample_modexp.h	RSA Modular exponentiation sample program header file
r_sample_sig_gen_vrfy.c	RSASSA-PKCS1-V1_5 sample program
r_sample_sig_gen_vrfy.h	RSASSA-PKCS1-V1_5 sample program header file
cstart.asm	Startup processing assembler file
f24opt.asm	Option Byte assembler file
RL78_RSA_Library_sample.mtpj	CS+ Project file
hdwinit.c	Peripheral unit initialization source file
iodefine.h	I/O Define header file
stkinit.asm	Stack area initialization assembler file
IAR <DIR>	IAR project folder
rl78_rsa_library_sample <DIR>	Sample project for F24
src<DIR>	Main function folder
main.c	Sample code source file
main.h	Sample code header file
r_sample_key.c	RSA Key sample source file
r_sample_key.h	RSA Key sample header file
r_sample_modexp.c	RSA Modular exponentiation sample program
r_sample_modexp.h	RSA Modular exponentiation sample program header file
r_sample_sig_gen_vrfy.c	RSASSA-PKCS1-V1_5 sample program
r_sample_sig_gen_vrfy.h	RSASSA-PKCS1-V1_5 sample program header file
option_byte.c	OPBT Setting file
sanle_linker_file_DF.ipcf	Sample Linker script file
rsa_library_sample.ewp	IAR Project file
rsa_library_sample.eww	IAR Project workspace file

2. Product Specifications

2.1 API Function

RSA Library for the RL78 supports the following functions.

Table 2. Library Functions (API)

API	Outline
R_RSA_ModExp	Modular exponentiation
R_RSA_SignatureGeneratePkcs	Signature Generation (RSASSA-PKCS1-V1_5)
R_RSA_SignatureVerifyPkcs	Signature Verification (RSASSA-PKCS1-V1_5)

3. Renesas Development Environment

3.1 Development environment

Please use the same or a later version of the toolchain listed below:

- Integrated Development Environment:
  CS+ for CC V8.07.00

- C compiler:
  CC-RL V1.11.00

3.2 ROM / RAM / Compiler option

The various sizes and processing cycles when building with the following options are described for reference.

-cpu=S3 -memory_model=medium -Odefault

Link options

-NOOPtimize

Table 4. ROM, RAM Size (CC-RL)

API	ROM size [byte]	RAM size [byte]
R_RSA_ModExp	2997 (3075)	2
R_RSA_SignatureGeneratePkcs	3270 (5634)	2
R_RSA_SignatureVerifyPkcs	3384 (5748)	2
RSA Library Total Size	4419 (13019) Note	2 Note

Note: () is the value including the SHA library (include SHA512 Module).
Since each function includes a common function, the required ROM capacity is smaller than the sum of each function.

Table 5. Stack Size (CC-RL)

API	stack size [byte]
R_RSA_ModExp	130
R_RSA_SignatureGeneratePkcs	1220
R_RSA_SignatureVerifyPkcs	1228

4. IAR Development Environment

4.1 Development environment

Please use the same or a later version of the toolchain listed below:

Integrated Development Environment:

IAR Embedded Workbench for Renesas RL78 version 4.21.4

C compiler:

IAR C/C++ Compiler for Renesas RL78 : 4.21.3.2447 (4.21.3.2447)

4.2 ROM / RAM / Compiler option

Library file is built with the following options.

--core=S3 --code_model=far --data_model=near --near_const_location=rom0 -e -Oh --calling_convention=default

Table 6. ROM, RAM Size (IAR)

API	ROM size [byte]	RAM size [byte]
R_RSA_ModExp	3474 (3623)	2
R_RSA_SignatureGeneratePkcs	3743 (6394)	2
R_RSA_SignatureVerifyPkcs	3871 (6522)	2
RSA Library Total Size	4852 (13048) Note	2 Note

Note: () is the value including the SHA library (include SHA512 Module).
Since each function includes a common function, the required ROM capacity is smaller than the sum of each function.

Table 7. Stack Size (IAR)

API	stack size [byte]
R_RSA_ModExp	130
R_RSA_SignatureGeneratePkcs	1124
R_RSA_SignatureVerifyPkcs	1142

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Nov 30,2022	—	First edition issued
1.01	Dec 27,2022	2	Filename change

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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