

RL78 Family

R20AN0159EJ0104

Rev.1.04

Open Source FAT File System M3S-TFAT-Tiny: Introduction Guide

Oct 01, 2015

Introduction

This document explains the usage of the Open Source FAT File System M3S-TFAT-Tiny for RL78 Family V.2.02 Release 00 (hereafter referred to as "TFAT library") along with a sample program.

Please refer to the User's Manual to understand how to use the software library. User's Manual is in this application note.

And, we prepared Sound Playback/Record demonstration software for the [YRDKRL78G14](#) as sample application program for TFAT Library.

Please refer to the following URL for details.

http://www.renesas.com/products/tools/middleware_and_drivers/tiny_soft/adpcm/m3s_s2_tiny/app_notes.jsp

(Document NO.: R20AN0194)

Target Device

RL78/G14

Contents

1. Structure of application note.....	3
2. Specification of library.....	4
2.1 Specification of TFAT library.....	4
2.2 Structure of software stack.....	4
3. For CS+ for CA, CX.....	5
3.1 Development environment.....	5
3.2 Compiler option for generating library.....	5
3.3 Version information.....	5
3.4 ROM size / RAM size / Stack size.....	6
3.5 Performance.....	7
3.6 Notes.....	7
4. For CS+ for CC.....	8
4.1 Development environment.....	8
4.2 Compiler option for generating library.....	8
4.3 Version information.....	8
4.4 ROM size / RAM size / Stack size.....	9
4.5 Performance.....	10
4.6 Notes.....	10
5. For IAR Embedded Workbench.....	11
5.1 Development environment.....	11
5.2 Compiler Option.....	11
5.3 Version information.....	11
5.4 ROM size / RAM size / Stack size.....	12
5.5 Performance.....	13
5.6 Notes.....	13
6. Usage of Libraries.....	14

1. Structure of application note

This application note includes files below.

Table 1 Structure of application note

name	description
r20an0159ej0104_rl78_tfat.pdf	Introduction Guide (this document)
Workspace (workspace)	
Document (doc)	
English (en)	
r20uw0078ej0200_tfat.pdf	User's Manual
r20an0159ej0104_rl78_tfat.pdf	Introduction Guide (this document)
Japanese (ja)	
r20uw0078jj0200_tfat.pdf	User's Manual
r20an0159jj0104_rl78_tfat.pdf	Introduction Guide
IAR (IAR)	
Library (lib)	
tfat_rl78_core_s2_m.a	TFAT library (Device / Code model / Data model) RL78 core S2 - Unspecified / Far / Near
tfat_rl78_core_s3_m.a	RL78 core S3 - Unspecified / Far / Near
r_tfat_lib.h	Library header file
r_stdint.h	Integer type define header file
r_mw_version.h	Version number definition file
Library generation environment (make_lib)	
Library source directory (src)	
Public Include header directory (pub_include)	
Build environment directory (tfat_rl78_iar)	
CS+ for CA, CX(CS+ for CA)	
Library (lib)	
tfat_rl78.lib	TFAT Library file (Medium model)
r_tfat_lib.h	Library header file
r_stdint.h	Integer type define header file
r_mw_version.h	Version number definition file
Library generation environment (make_lib)	
Library source directory (src)	
Public Include header directory (pub_include)	
Build environment directory (tfat_rl78)	
CS+ for CC(CS+ for CC)	
Library (lib)	
tfat_rl78.lib	TFAT Library file (Medium model)
r_tfat_lib.h	Library header file
r_stdint.h	Integer type define header file
r_mw_version.h	Version number definition file
Library generation environment (make_lib)	
Library source directory (src)	
Public Include header directory (pub_include)	
Build environment directory (tfat_rl78)	

2. Specification of library

2.1 Specification of TFAT library

Following are some of the main specifications of the TFAT library.

Table 2 Specification of TFAT library

item	specifications
Base program	Fatfs (R0.06)
Supported FAT Type	FAT12, FAT16, FAT32
Filename Support	8.3 format (8 lettered filename & 3 lettered extension) Long file name format is not supported.
Number of drives supported	1
Logical Sector size	512byte
Filesystem format function	None

2.2 Structure of software stack

Following are structure of software stack of the TFAT library.

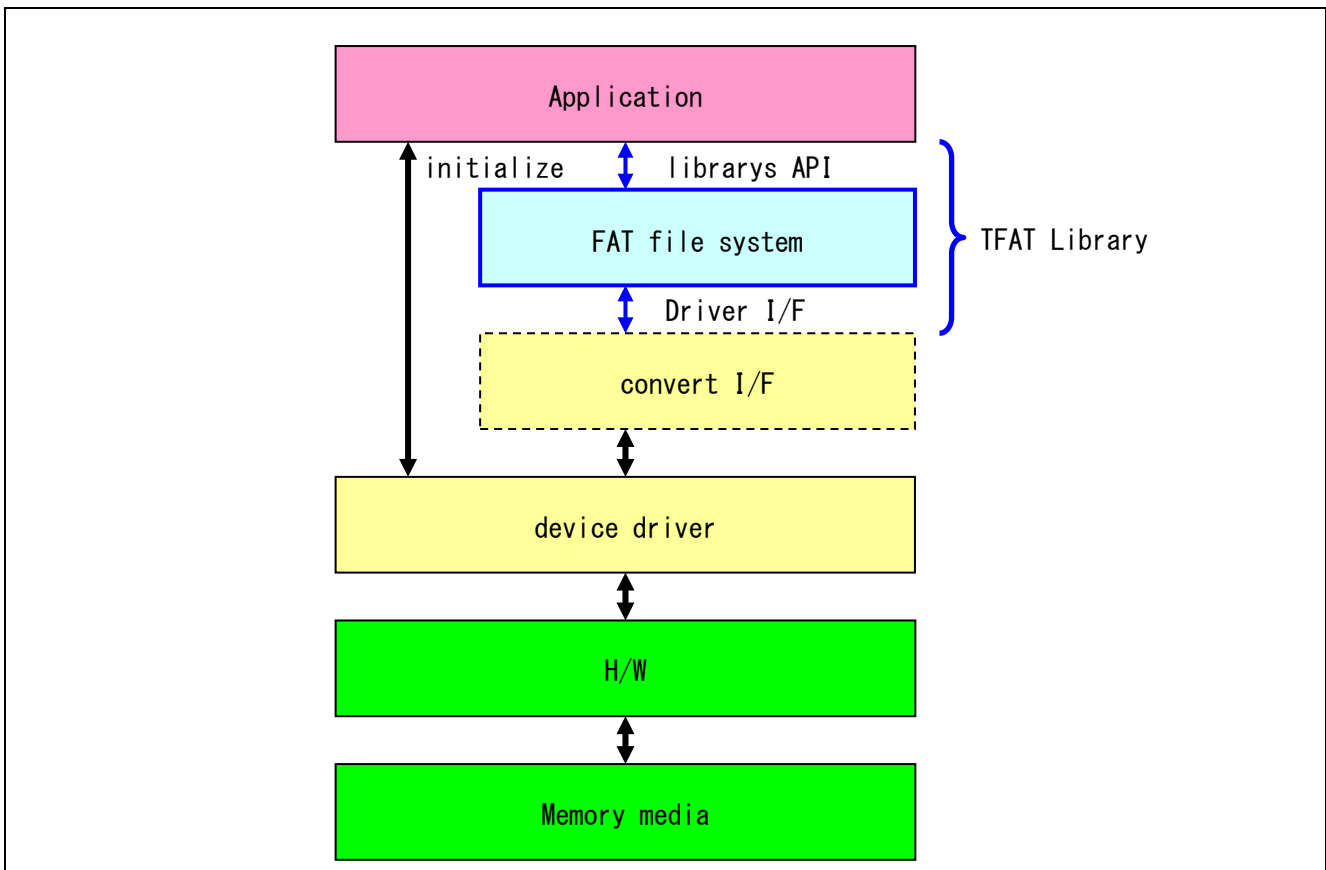


Figure 2-1 structure of software stack of the TFAT library

3. For CS+ for CA, CX

3.1 Development environment

TFAT library can run with this development environment below.

[Software tools]

- Integrated Development Environment
CS+ for CA,CX V3.00.01
- C compiler
CA78K0R V1.71

3.2 Compiler option for generating library

Library file is built with compile option. It changed the following options from the default option.

Add debug information : No(-ng)

Output common object file for various devices : Yes(-common)

3.3 Version information

TFAT library has version information as strings. User can access this version information to use extern variable defined in header file.

```
define: extern const mw_version_t R_tfath_version;
```

TFAT library has version information showed below.

```
"M3S-TFAT-Tiny version 2.02 for RL78 (S2, MEDIUM).(Nov 13 2015, 11:19:33)"
```

3.4 ROM size / RAM size / Stack size

TFAT library requires ROM/RAM/Stack size as below.

Table 3 ROM/RAM size

kind	size
ROM (CSEG)	about 12.7KB
RAM (DSEG)	4byte
Stack size [Note]	about 200byte

Note: Stack size is dependent on user-defined function.

At least one variable of the structure FATFS is always required for FileSystem Work Area allocation. The FIL and DIR structures will be needed as per the requirement. The number of FIL variables needed is equal to the number of files that will be opened simultaneously by the user. If two files are to be opened simultaneously, then two FIL structure variables will be needed resulting in total memory consumption of $32 \times 2 = 64$ Bytes. Likewise will be the case with DIR and other structure variables.

Table 4 structure size

Structure	Memory for one structure variable [byte]
FATFS	558
FIL	32
DIR	18
FILINFO	22

3.5 Performance

The access time that TFAT library reads/write memory card is below.

Table 5 Performance

	Test Condition	Time
RI78/G14	Time to write 1MByte data file. (File Open , Data write ,File close)	About 4.2 Sec
	Time to read 1MByte data file. (File Open , Data read ,File close)	About 2.2 Sec

Detail of test condition is below.

Table 6 Measurement condition

	Detail of Test Condition	Contents
RL78/G14	CPU Clock(fCLK)	32MHz
	Memory	Transcend SD 2GB
	FAT type	FAT32
	Cluster size	2048byte
	Driver software	Renesas MMC driver (R20AN0158JJ0101)
	Source data area when data write.	Internal ROM (Mirror area)
	Destination data area when data read.	Internal RAM

3.6 Notes

- Library is using the following standard function.
memset memcmp memcpy
- This library corresponds Medium model.
When user use othe memory models with TFAT library, please re-build the library that corresponds to user memory models, using library build environment included in the package.

4. For CS+ for CC

4.1 Development environment

TFAT library can run with this development environment below.

[Software tools]

- Integrated Development Environment
CS+ for CC V3.01.00
- C compiler
CC-RL V1.01

4.2 Compiler option for generating library

Library file is built with compile option. It changed the following options from the default option.

Add debug information : No
Use arithmetic unit : Not use(-use_mda=not_use)
Specify mirror area : Common(-asmopt=-mirror_source=common)
Memory model : Medium model(-memory_model=medium)

4.3 Version information

TFAT library has version information as strings. User can access this version information to use extern variable defined in header file.

```
define: extern const mw_version_t R_tfat_version;
```

TFAT library has version information showed below.

```
"M3S-TFAT-Tiny version 2.02 for RL78 (CCRL, S2, MEDIUM).(Nov 13 2015, 11:18:28)"
```


4.4 ROM size / RAM size / Stack size

TFAT library requires ROM/RAM/Stack size as below.

Table 7 ROM/RAM size

kind	size
ROM (CSEG)	about 10.0KB
RAM (DSEG)	4byte
Stack size [Note]	about 240byte

Note: Stack size is dependent on user-defined function.

At least one variable of the structure FATFS is always required for FileSystem Work Area allocation. The FIL and DIR structures will be needed as per the requirement. The number of FIL variables needed is equal to the number of files that will be opened simultaneously by the user. If two files are to be opened simultaneously, then two FIL structure variables will be needed resulting in total memory consumption of $32 \times 2 = 64$ Bytes. Likewise will be the case with DIR and other structure variables.

Table 8 structure size

Structure	Memory for one structure variable [byte]
FATFS	558
FIL	32
DIR	18
FILINFO	22

4.5 Performance

The access time that TFAT library reads/write memory card is below.

Table 9 Performance

	Test Condition	Time
RI78/G14	Time to write 1MByte data file. (File Open , Data write ,File close)	About 4.1 Sec
	Time to read 1MByte data file. (File Open , Data read ,File close)	About 2.0 Sec

Detail of test condition is below.

Table 10 Measurement condition

	Detail of Test Condition	Contents
RL78/G14	CPU Clock(fCLK)	32MHz
	Memory	Transcend SD 2GB
	FAT type	FAT32
	Cluster size	2048byte
	Driver software	Renesas MMC driver (R20AN0158JJ0101)
	Source data area when data write.	Internal ROM (Mirror area)
	Destination data area when data read.	Internal RAM

4.6 Notes

- Library is using the following standard function.
memset memcmp memcpy
- This library corresponds Medium model.
When user use othe memory models with TFAT library, please re-build the library that corresponds to user memory models, using library build environment included in the package.

5. For IAR Embedded Workbench

5.1 Development environment

TFAT library can run with this development environment below.

[Software tools]

-Integrated Development Environment and C compiler

IAR Embedded Workbench for Renesas RL78 version 2.10.1

-Code Generator tool

Applilet3 for RL78 V1.09.00 Renesas

[board]

The sample program that uses TFAT-IAR version is in the following Application note.

Document title: Sound Playback/Compression demonstration software for RL78/G14 CPU board
(Document number: R20AN0194)

Please download the sample code clicking following URL.

http://www.renesas.com/products/tools/middleware_and_drivers/tiny_soft/adpcm/m3s_s2_tiny/app_notes.jsp

5.2 Compiler Option

This product is specifically built for RL78 with the following compiler options:

```
tfat_rl78_core_s2_m.a:  
  --calling_convention v2 --double=32 --core s2 --code_model far  
  --data_model near --near_const_location rom0 -e -Oh -D NDEBUG
```

```
tfat_rl78_core_s3_m.a:  
  --calling_convention v2 --double=32 --core s3 --code_model far  
  --data_model near --near_const_location rom0 -e -Oh -D NDEBUG
```

5.3 Version information

TFAT library has version information as strings. User can access this version information to use extern variable defined in header file.

```
define:    extern const mw_version_t R_tfat_version;
```

TFAT library has version information showed below.

• tfat_rl78_core_s2_m.a:

"M3S-TFAT-Tiny version 2.02 for RL78 (IAR, S2, code_model=far, data_model=near).(Nov 13 2015, 11:17:15)"

• tfat_rl78_core_s3_m.a:

"M3S-TFAT-Tiny version 2.02 for RL78 (IAR, S3, code_model=far, data_model=near).(Nov 13 2015, 11:17:29)"

5.4 ROM size / RAM size / Stack size

TFAT library requires ROM/RAM/Stack size as below.

Table 11 ROM/RAM size

kind	size
ROM (.text .const)	about 9KB
RAM (.bss)	4byte
Stack size [Note]	about 200byte

Note: Stack size is dependent on user-defined function.

At least one variable of the structure FATFS is always required for FileSystem Work Area allocation. The FIL and DIR structures will be needed as per the requirement. The number of FIL variables needed is equal to the number of files that will be opened simultaneously by the user. If two files are to be opened simultaneously, then two FIL structure variables will be needed resulting in total memory consumption of $32 \times 2 = 64$ Bytes. Likewise will be the case with DIR and other structure variables.

Table 12 structure size

Structure	Memory for one structure variable [byte]
FATFS	558
FIL	32
DIR	18
FILINFO	22

5.5 Performance

The access time that TFAT library reads/write memory card is below.

Table 13 Performance

	Test Condition	Time
RI78/G14	Time to write 1MByte data file. (File Open , Data write ,File close)	About 5.5 Sec
	Time to read 1MByte data file. (File Open , Data read ,File close)	About 2.0 Sec

Detail of test condition is below.

Table 14 Measurement condition

	Detail of Test Condition	Contents
RL78/G14	CPU Clock(fCLK)	32MHz
	Memory	Transcend MMC 256MB
	FAT type	FAT32
	Cluster size	2048byte
	Driver software	Renesas MMC driver (R20AN0158JJ0101)
	Source data area when data write.	Internal ROM (Mirror area)
	Destination data area when data read.	Internal RAM

5.6 Notes

- Library is using the following standard function.
memset memcmp memcpy
- This library corresponds Code model = Far, Data model = Near.
When user use other memory models with TFAT library, please re-build the library that corresponds to user memory models, using library build environment included in the package.

6. Usage of Libraries

Please include a library file and a header file in a project.

TFAT library does not contain the driver of a memory media (SD card and a USB memory). Please prepare the driver of a memory media by the user side in accordance with the hardware of use.

Please set the driver of a memory media by Memory driver interface of TFAT library. Please refer to a user's manual about Memory driver interface.

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Revision History

Rev.	Date	Description	
		Page	Summary
1.04	Oct 01, 2015	—	Changed CubeSuite+ to CS+ for CA,CX Supported CS+ for CC. Deleted sample program.
1.03	Sep 01, 2014	—	Supported IAR Embedded Workbench.
1.02	Nov 08, 2013	—	Changed document title Changed the structure of sections Added Fatfs copyright to library source
1.01	Jan 31, 2013	—	Product structure is changed. C hanged into ZIP download form from installer form. Change of development environment Compiler version is corrected Correction of library stack size Performance is added. Change of written contents of appendix The connection information on a memory card conversion board and RL78/G14 CPU board is added. A wiring schematic view and RL778/G14 CPU board appearance photograph are added.
1.00	Mar.31.12	—	First edition issued

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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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