V850 Family

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

Introduction

This document explains the usage of the Open Source FAT File System M3S-TFAT-Tiny for the V850 Family V.2.00 Release 01 (hereafter referred to as "TFAT library") along with a sample program.

Target Device

V850E2/ML4 (μPD70F4022)

Contents

1. Structure of application note

This application note includes files below.

Table 1.1 Structure of application note

name	description
r01an1028ej0102_v850e2ml4.pdf	Introduction Guide (this document)
Workspace (workspace)	
Document (doc)	
English (en)	
r20uw0078ej0200_tfat.pdf	User's Manual
r01an1028ej0102_v850e2ml4.pdf	Introduction Guide (this document)
Japanese (ja)	
r20uw0078jj0200_tfat.pdf	User's Manual
r01an1028jj0102_v850e2ml4.pdf	Introduction Guide
Library (lib)	
libtfat_v850e2m.lib	Library file for V850E2M (*)
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)	
r_TinyFAT.c	Library source
r_version.c	Library source
r_TinyFAT.h	Library source
Public Include header directory (pub_include)	
r_tfat_lib.h	Library header file
r_stdint.h	Integer type define header file
r_mw_version.h	Version number definition file
tfat_v850e2	Build environment directory for V850E2
Sample program (sample)	
TFAT_sample_V850E2_with_MMC	Sample program for V850E2/ML4 with MMC driver by CubeSuite+

Note: Supports the V850E2M core. The V850 and V850ES cores cannot be used.

2. Specification of library

2.1 Specification of TFAT library

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

Table 2.1 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

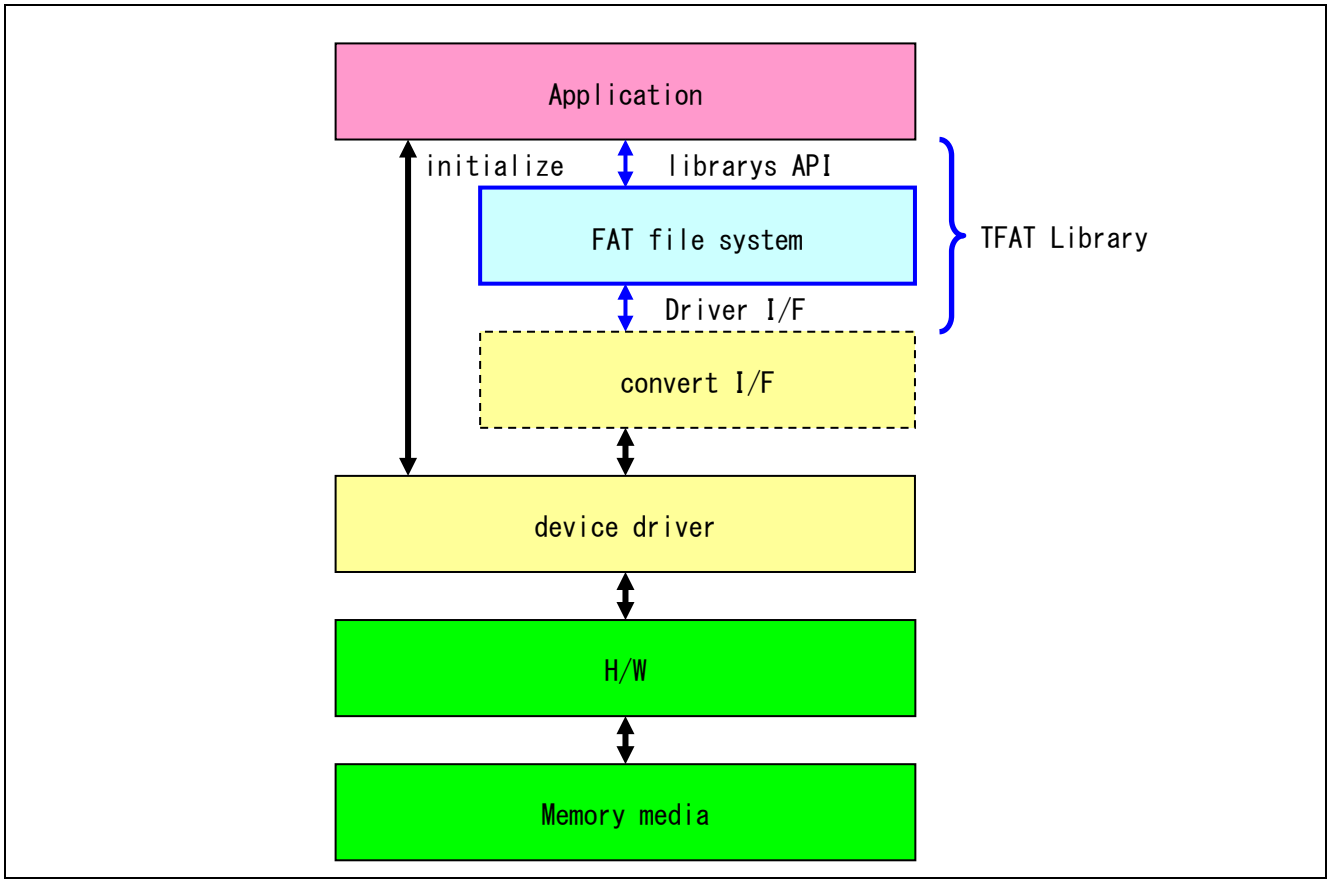

Figure 2.1 structure of software stack of the TFAT library

2.3 Development environment

This software operates under the following development environment.

[Software tools]

- Integrated development environment
  CubeSuite+ V1.02.00
- C compiler
  CubeSuite+ V850 compiler CX V1.21

[Debug tools]

- Emulator debugger
  E1 emulator

[Board]

- V850E2/ML4 CPU Board Renesas (type : R0K0F4022C000BR)
- Memory card slot expansion board Renesas (type : R0K0F4022B010BR)

2.4 Compiler option for generating library

The library can be built with the following option changes made to the default state.

- Output device common objects: Yes (V850E2 core common) (-v850e2)

2.5 Version Information

User can access TFAT Library information with valuable below.

```
extern const mw_version_t R_tfat_version;

Library file for V850E2M:
  "M3S-TFAT-Tiny version 2.00 for V850E2.(Aug 23 2012, 11:17:33)"
```

2.6 ROM size / RAM size / Stack size

The table below lists the ROM, RAM, and stack sizes used by this library.

Table 2.2 ROM/RAM Sizes

Classification (section name)	Size
ROM (.text .data)	About 8.2 KB
RAM (.sbss)	6 bytes

Table 2.3 Stack Sizes

API Function	Stack Size (bytes)
R_tfat_f_mount	0
R_tfat_f_open	228
R_tfat_f_close	52
R_tfat_f_read	100
R_tfat_f_write	144
R_tfat_f_lseek	132
R_tfat_f_truncate	100
R_tfat_f_sync	44
R_tfat_f_opendir	164
R_tfat_f_readdir	100
R_tfat_f_getfree	112
R_tfat_f_stat	180
R_tfat_f_mkdir	236
R_tfat_f_unlink	200
R_tfat_f_chmod	184
R_tfat_f_utime	176
R_tfat_f_rename	240
R_tfat_f_forward	96

Note: User defined functions depend on the following driver software.

At least one variable of the FATFS structure is required to allocate the file system working area. Depending on the requirements, FIL and DIR structures will be required. The number of FIL variables required is the same as the number of files to be opened at the same time. If two files are to be opened at the same time, two FIL structure variables are required and the total memory requirement will be 36 × 2 = 72 bytes. The calculations for DIR and other structure variables are similar.

The following table lists the sizes of these structures.

Table 2.4 Structure Sizes

Structure	Memory Size (in bytes) for a Single Structure Variable
FATFS	560
FIL	36
DIR	20
FILINFO	24

2.7 Performance

This list shows below writing time and the reading time for file of the case using the TFAT library.

Table 2.1 Time required

Outline	Time required
1MBytes data write time (File open , Data write , and File close)	About 2 sec
1MBytes data read time (File open , Data read , and File close)	About 1.6 sec

Table 2.6 shows measurement condition

Table 2.2 Measurement condition

Outline	Contents
CPU Clock(fCPU)	200MHz
Peripheral Clock(fPCLK)	66.7MHz
Used memory media	Transcend MMC 256MB
FAT type	FAT32
Driver software	Renesas MMC Driver (Document No : R01AN1026JJ0100)
Source area of the data writing	Internal ROM
Destination area of the data reading	Internal RAM

2.8 Notes

The following standard functions are used in the library.

memset memcmp memcpy

3. Usage of Libraries

Embed the library and header files in a project by copying them.

The TFAT library does not include drivers for the storage media (e.g. SD cards or USB memory). The user must provide storage media drivers for the hardware used.

The storage media drivers must match the TFAT library media driver interface. See the user's manual for details on the memory driver interface.

4. Sample program

4.1 Overview

The sample program is a CubeSuite+ project that operates on the V850E2/ML4 CPU board (the CPU board) plus Memory card slot expansion board plus the E1 emulator. Note that the sample program does not implement memory driver interface functions and that these must be provided by the user. There is an implementation example using an MMC driver (see the first related application note), which we recommend referring to.

4.2 Operation

When the program is run, a FAT file system working area is registered on the media card. A file is created on the media card and 2K bytes of text data is written to a file. After that, the file is closed. To verify the written data, the file is opened again in read mode. The whole contents of the file are read and compared to the data in the program's write buffer. Whether or not that data matches is indicated in the LEDs on the CPU board.

Table 4.1 LED Display Meanings

LED3(P4_4)	LED2(P4_3)	Meaning
ON	OFF	Execution in progress
OFF	ON	Error termination
ON	ON	Normal completion

Data for reading and writing files is defined in the r_data_file.c header file. As a default, the character string "Renesas" is written repeatedly. The total amount of data written is 2K bytes (2048 bytes). If required, this data and the corresponding macro FILESIZE may be edited.

4.3 Processing Flow

Figure 4.1 shows the flowchart for the processing performed by the sample program.

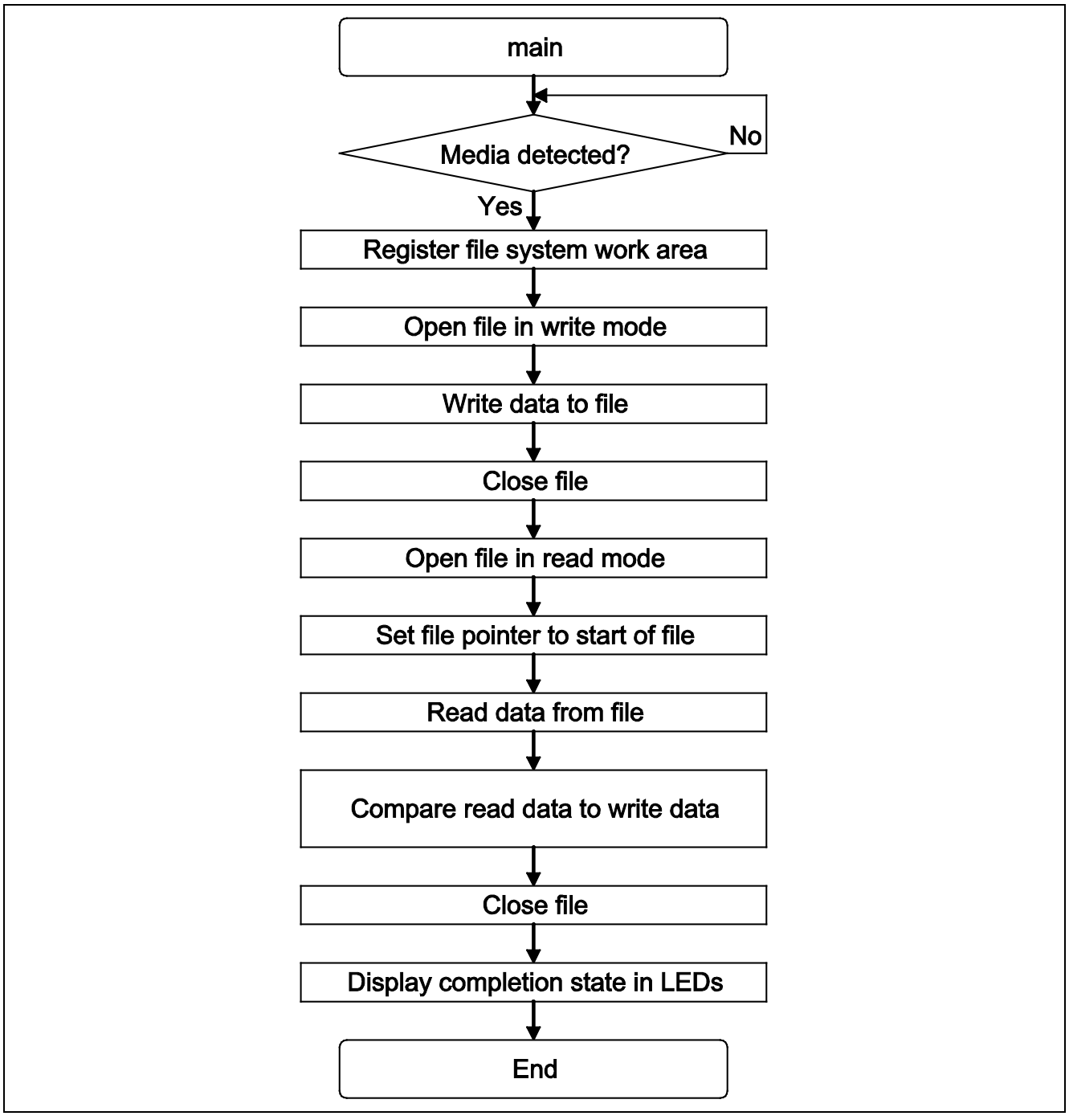

Figure 4.1 Sample Program Flowchart

4.4 Change to MMC Driver

Among the connection terminals which an MMC driver defines CS terminal (port P2_5) and detection terminal (port P7_0) are not connected to Memory card slot expansion board. Sample program changes the program of MMC driver to work in environment of CPU board and Memory card slot expansion board.

- r_mmc_user_config.h Line 20:
  CS terminal defines Port P2_10, and CardDetect terminal defines Port P1_0.

```
#define  MMC_CS_PORT            P2       /* CS Port Setting     */ /** SET **/
#define  MMC_CS_BIT             0x0400U  /* CS Bit Select       */ /** SET **/

#define MMC_DETECT_PORT         PPR1     /* DETECT Port Setting */ /** SET **/
#define MMC_DETECT_BIT          0x0001U  /* DETECT Bit Select   */ /** SET **/
```

- r_mmc_sfr.h Line 76
  MMC_IO_INIT() macro changes.

```
#define MMC_IO_INIT() do {      /* Driver use terminal initial setting */   \
        /* SI1F input buffer enable setting   */                            \
        PIBC2   = _0100_PIBCn8_INBUF_ENABLE;                                \
        /* DETECT input buffer enable setting */                            \
        PIBC1   |= _0001_PIBCn0_INBUF_ENABLE;                               \
        /* DETECT input mode setting          */                            \
        PM1     |= _0001_PMn0_MODE_INPUT;                                   \
        /* P2_6~P2_7,CS(P2_10)  "H"level setting        */                 \
        P2      |= (MMC_CS_BIT | _0040_Pn6_OUTPUT_1 | _0080_Pn7_OUTPUT_1);  \
        /* P2_6~P2_7,CS(P2_10) output ,P2_8 input      */                   \
        PM2     |= (_0040_PMn6_MODE_UNUSED | _0080_PMn7_MODE_UNUSED |
_0100_PMn8_MODE_INPUT); \
        /* P2_6~P2_7,CS(P2_10) "H"                     */                   \
        P2      |= (MMC_CS_BIT | _0040_Pn6_OUTPUT_1 | _0080_Pn7_OUTPUT_1);  \
} while (0)
```

- r_mmc_sfr.h Line 112
- MMC_SET_CS() macro changes CS terminal control.

```
#define MMC_SET_CS(SlotNo, Lv) do {     /* CS output control */          \
      if(Lv){                                                           \
                MMC_CS_PORT |= (MMC_CS_BIT);                            \
      }                                                                 \
      else                                                              \
      {                                                                 \
                MMC_CS_PORT &= (~MMC_CS_BIT);                           \
      }                                                                 \
} while (0)
```

- CG_port.c Line 119
  Port P2_10 and Port P1_0 initialize setting.

```
/* Set CS pin (P2_10,output) */
PDSC2  |= _0000_PDSCn10_DRV_LOW;
PMC2   |= _0000_PMCn10_OPER_PORT;
PM2    &= _FBFF_PMn10_MODE_OUTPUT;

/* DETECT terminal P1_0 setting*/
PISA1  |= _0001_PISAn0_INBUF_TYPE5; /* P1_0 Input buffer permission */
PIBC1  |= _0001_PIBCn0_INBUF_ENABLE;/* P1_0 Input buffer permission */
PMC1   |= _0000_PMCn0_OPER_PORT;   /* P1_0 Port mode setting       */
PM1    |= _0001_PMn0_MODE_INPUT;   /* P1_0 Input mode setting      */
```

4.5 Notes

The sample code that included this application note uses MMC driver as memory device driver.

Max usable capacity of MMC driver is 2GB.

If user needs larger size than 2GB, please use USB host driver with USB memory.

If user uses USB host driver, please refer to the application note "V850E2/ML4 USB Host Software".

5. Reference Documents

- Hardware Manual
  V850E2/ML4 User's Manual: Hardware [R01UH0262EJ]
  (The latest version can be downloaded from the Renesas Electronics Web site.)
- Software Manual
  V850E2M User's Manual: Architecture [R01US0001EJ]
  (The latest version can be downloaded from the Renesas Electronics Web site.)
- Related User's Manual
  R0K0F4022B010BR User's Manual [R20UT2111EJ]
  (The latest version can be downloaded from the Renesas Electronics Web site.)
- Related application notes
  [1] V850E2/ML4 Multimedia Card SPI Mode Device Driver [R01AN1027EJ0100]
  [2] V850E2/ML4 USB Host Software [R01AN1217EJ]
  (The latest version can be downloaded from the Renesas Electronics Web site.)

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Revision History

		Description	
Rev.	**Date**	**Page**	**Summary**
1.02	Nov 08, 2013	all	Changed document title Changed the structure of sections Added Fatfs copyright to library source
1.01	Sep 20, 2012	all	Changed document No. to R01AN1028. Release with TFAT library Ver.2.00.
1.00	Apr 25, 2012	—	First edition issued

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1. Handling of Unused Pins
   Handle unused pins in accord 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.
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   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.
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5. Differences between Products
   Before changing from one product to another, i.e. to a product with a different type number, confirm that the change will not lead to problems.
   — The characteristics of an MPU or MCU in the same group but having a different part number may differ in terms of the 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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