

SD card Tiva C library

Version 2.0



Javier Martínez Arrieta

martinezarrietajavier@gmail.com

Contents

Abstract 3

License 3

Acknowledgements 4

Files..... 4

Available functions 4

Bugs found..... 5

Connections..... 6

 SSI0 6

 SSI1 7

 SSI2 7

 SSI3 7

Abstract

This is a short guide to be used as guidance in order to know how to use the library so as to read an SD card and (hopefully in the future) write in it. This library has been tested with the TM4C123GH6PM microcontroller, so take it into account in case you wish to use it with another microcontroller as there might be necessary to make some changes.

License

This project is licensed under *Creative Commons Attribution-Non Commercial-Share Alike 4.0 International (CC BY-NC-SA 4.0)*. According to this license you are free to:

Share — copy and redistribute the material in any medium or format.

Adapt — remix, transform, and build upon the material.

The licensor cannot revoke these freedoms as long as you follow the license terms.

Complete information about this license can be found at:

<https://creativecommons.org/licenses/by-nc-sa/4.0/legalcode>

Part of the library (partially modified functions `rcvr_datablock`, `rcvr_spi_m`, `disk_timerproc`, `Timer5A_Handler`, `Timer5_Init`, `is_ready`, `send_command` as well as part of `initialize_sd`) accompanies the books

Embedded Systems: Real-Time Operating Systems for ARM Cortex-M Microcontrollers, Volume 3,

ISBN: 978-1466468863, Jonathan Valvano, copyright (c) 2013

Volume 3, Program 6.3, section 6.6 "Embedded Systems: Real Time Interfacing to Arm Cortex M Microcontrollers",

ISBN: 978-1463590154, Jonathan Valvano, copyright (c) 2013

Copyright 2013 by Jonathan W. Valvano, valvano@mail.utexas.edu

You may use, edit, run or distribute this file (concretely the functions mentioned)

as long as the above copyright notice remains

THIS SOFTWARE IS PROVIDED "AS IS". NO WARRANTIES, WHETHER EXPRESS, IMPLIED

OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF

MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE APPLY TO THIS SOFTWARE.

VALVANO SHALL NOT, IN ANY CIRCUMSTANCES, BE LIABLE FOR SPECIAL, INCIDENTAL,

OR CONSEQUENTIAL DAMAGES, FOR ANY REASON WHATSOEVER.

For more information about my classes, my research, and my books, see

<http://users.ece.utexas.edu/~valvano/>

Acknowledgements

I would like to thank the people which work helped me to understand how the FAT32 filesystem works and also to convert it to the final code. Those people are:

-Paul Stoffregen for summarising how does FAT32 works at <https://www.pjrc.com/tech/8051/ide/fat32.html>

-Jonathan Valvano for the example code that I could make use of for some of the functions. The SD card example plus others are available at <http://users.ece.utexas.edu/~valvano/arm/>

-Those who wrote the content of http://elm-chan.org/docs/mmc/mmc_e.html

Files

There are three files used for this CCS project along with the Tivaware library, so in case you don't have it installed you will need it as some definitions come from that library. The main files are:

-main.c : This file contains references to the library files and example code.

-sdcard.h: This header file contains the definitions of functions and constants.

-sdcard.c: This file contains the implementation of the functions to read from the SD card.

Available functions

The functions available are the following:

-**unsigned char** **sd_read**(**enum** SSI SSI_number): Reads from the SD card by getting the data received through the SSI line.

-**unsigned char** **is_ready**(**enum** SSI SSI_number): Waits until the SD card is ready to be read.

-**unsigned char** **send_command**(**unsigned char** command, **unsigned long** argument, **enum** SSI SSI_number): Sends a command to the SD card.

-**void** **initialize_sd**(**enum** SSI SSI_number): Initialises the SD card to be read as SSI

-**void** **startSSI0**(): Configures SSI0 to read from the SD card.

-**void** **startSSI1**(): Configures SSI1 to read from the SD card.

-**void** **startSSI2**(): Configures SSI2 to read from the SD card.

-**void** **startSSI3**(): Configures SSI3 to read from the SD card.

-**void** **tx_SSI**(**enum** SSI SSI_number)

-**void** **change_speed**(**enum** SSI SSI_number): Changes the communication speed after the SD card has been initialized.

-**void** **read_first_sector**(**enum** SSI SSI_number): Reads the first sector of the SD card to get information required to be able to read from the SD card.

-void read_disk_data(enum SSI SSI_number): Gets information required to be able to read the SD card

-long get_files_and_dirs(long next_cluster, enum name_type name, enum get_subdirs subdirs, enum SSI SSI_number): Lists the directories and files that are found in the SD card, including the subdirectories if specified and showing the short or the long filename. If the file and directories found are regular ones.

-long open_file(long next_cluster, enum SSI SSI_number): Reads the content of the file specified. Please note that this fully works for txt files. In case of other type of files, it will be read but some action will be required with its content.

-void clean_name(): Removes the NULL(0x00) characters from the directory or file name before showing to the user.

-void Timer5_Init(void): Initialises Timer number five.

-void Timer5A_Handler(void): Acknowledges the timer number five that the timeout has been reached.

-void disk_timerproc(void): Decrements the timers.

-unsigned int rcvr_datablock (unsigned char *buff, unsigned int btr, enum SSI SSI_number): Receives a 512 byte block from the SD card through the SSI specified.

-void rcvr_spi_m(unsigned char *dst, enum SSI SSI_number): Reads a block from the SSI.

Minimum code to make it work

The following code is an example of the minimum code required in order to make the library work as expected. See in the comments what does the code do.

```
#include "sdcard.h"
#include <stdio.h>

int main(void)
{
    //Configure the SSI3 in order to interact with the SD card
    startSSI3();

    //If your adapter has as Card Detector(CD) pin, you can uncomment
the following in order to wait until a card is inserted to continue
    /*GPIO_PORTD_DIR_R &= ~0x40; //Set PD6 as input
    uint8_t continue_prog=0;
    while(continue_prog == 0)
    {
        char read = GPIO_PORTD_DATA_R&0x40;
        if(read == 0x00)
        {
            continue_prog=1;
        }
    }*/

    //Initialise the SD card
    SysTick_Wait50ms(40);
    initialise_sd(SSI3);
    cs_high(SSI3);
    change_speed(SSI3);
    cs_low(SSI3);

    //Read the information that will allow you to detect files and
directories
    read_first_sector(SSI3);
    read_disk_data(SSI3);
```

```

long next_cluster=get_root_dir_first_cluster();

//Look for files and directory names and save in a structure
do
{
    next_cluster=get_files_and_dirs(next_cluster, LONG_NAME, GET_SUBD
IRS, SSI3);
}while(next_cluster!=0xFFFFFFFF && next_cluster!=0xFFFFFFFF);
printf("\nDirs and files listed\n\n");

//For the file sored in position 5 of the structure, open it and
read its content
//Important note: Further code should be developed if not reading
plain text files.
next_cluster=get_first_cluster(5);
do
{
    next_cluster=open_file(next_cluster, SSI3);
}while(next_cluster!=0xFFFFFFFF && next_cluster!=0xFFFFFFFF);
return 0;
}

```

Bugs found

In previous version (1.0), using more than one SSI supposed that, when configuring the clock of a second SSI, the clock of the first one was disabled (e.g. if startSSI0 is used and later startSSI1 is called, then SSI0 clock was deactivated). The latest version solved the bug and no change in configuration is required.

Connections

There are four possible SSIs to be used in order to connect the screen. Depending on which SSI is used, the connection should be as follows:

SSI0

Board	SD card adapter
PA2	SCK
PA3	CS
PA4	MISO
PA5	MOSI
3.3V	VCC
GND	GND

SSI1

Board	SD card adapter
PF0	MISO
PF1	MOSI
PF2	SCK
PF3	CS
3.3 V	VCC
GND	GND

SSI2

Board	SD card adapter
PB4	SCK
PB5	CS
PB6	MISO
PB7	MOSI
3.3 V	VCC
GND	GND

SSI3

Board	SD card adapter
PD0	SCK
PD1	CS
PD2	MISO
PD3	MOSI
3.3 V	VCC
GND	GND