

VS1000B/C AUDIO BOOK

VS1000 “VLSI Solution Ogg Vorbis Player”

Project Code:
Project Name: VS1000

Revision History			
Rev.	Date	Author	Description
0.92	2008-10-31	PO	Public domain content, works with Developer Board.
0.9	2008-02-05	PO	Menu file format changed.
0.8	2008-01-23	PO	Programming instructions update, low-voltage poweroff disabled.
0.7	2008-01-07	PO	Better menu generator, a few additions.
0.6	2007-12-20	PO	First beta version.
0.5	2007-11-26	PO	Initial version.

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1 VS1000 Audio Book

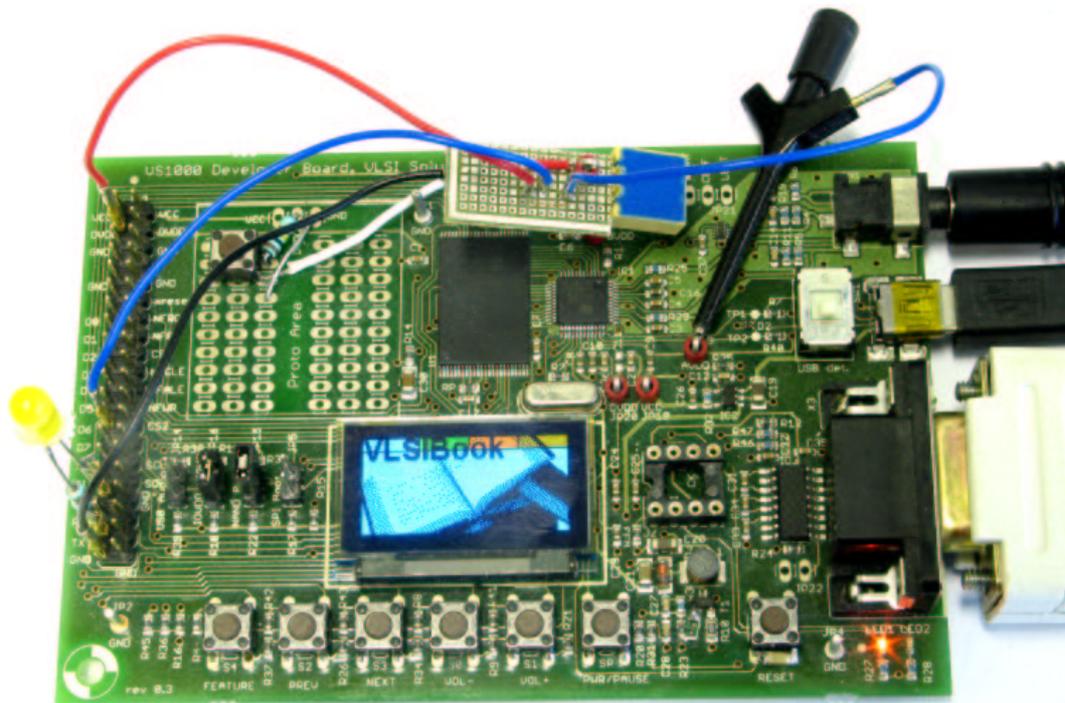


Figure 1.1: VS1000 Audio Book

- Graphical startup screen and main menu heading.
- A menu system described in MENU.MNU is used.
- A menu entry can point to a sample-exact position in an Ogg Vorbis file.
- Allows browsing menu during audio playback.
- Battery level measurement.
- Bookmarks and keylock.
- Backlight timer.
- Can also use a display with parallel interface.

1.1 Introduction

This document shows the main features of the VS1000 Audio Book, and talks about how some things are implemented. Free code space and the structure of code limits which improvements are possible.

To make it easier to change files, the USB mass storage is enabled. The USB is only detected at poweron, and only Mass Storage is supported. If a valid FAT filesystem or the menu file is not found, the software waits for USB to be attached.

For code space reasons the software is in three separate programs. This is why the software can not be loaded and run with the emulator.

- Init - performs initialization, reads settings and bookmarks, shows startup screen, and detects USB.
- Book - implements the player and menu system.
- Power off - saves settings and bookmarks, turns the unit off.

Changes required to the VS1000 Developer Board:

- Extra button added to GPIO0[5] for bookmark / lock. The software can be tested without the button.
- Battery level measurement using a comparator in GPIO0[6]. Without the extra circuit battery is shown to be empty (JP14 open) or full (JP14 closed).
- Backlight LED connected between TX and IOVDD (with a resistor).
- A 1 nF capacitor added to reset line for better OLED display reset.

1.2 Keys

The VS1000 Audio Book uses one extra key in addition to the normal keys. The extra key is added to GPIO0[5] in the same way as the other other keys on GPIO0. The following key arrangement is recommended for a product.

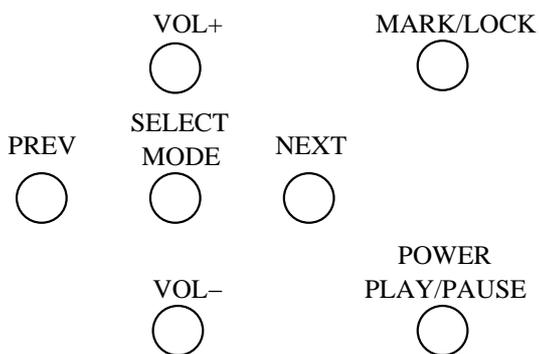


Figure 1.2: Suggested Key Arrangement

1.3 Battery Level Measurement

VS1000 does not have an analog-to-digital converter that could be used for monitoring battery voltage. However, in player mode the voltage of the AVDD regulator can be changed quite freely without it affecting the audio quality (20 steps from 12 to 31). By using a simple comparator circuit the AVDD can act as a changeable reference to find out what the battery voltage level is.

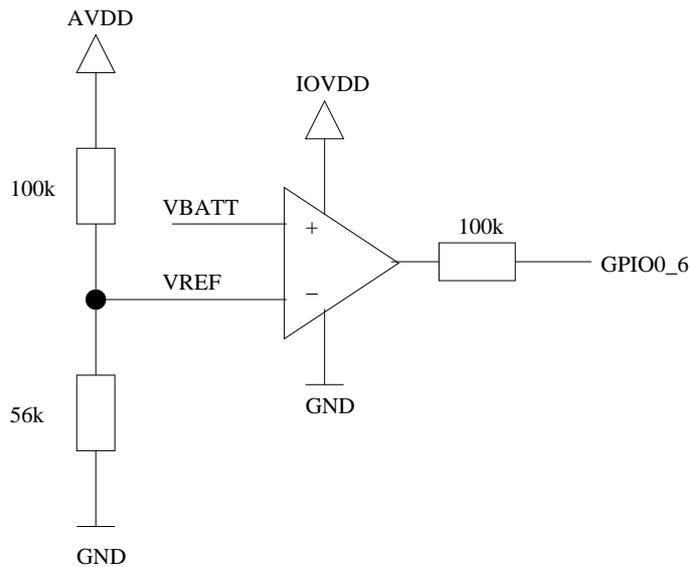


Figure 1.3: Voltage Monitor

The resistor divider in AVDD determines the comparison range.

In the VS1000 Audio Book battery measurement is done at startup and once per second. The battery voltage is compared to a reference voltage and the result is read using GPIO0_6. The reference voltage is generated from AVDD using a resistor divider. Because AVDD can be changed by controlling the internal regulators, the battery voltage can be measured with 20 steps.

Measurement is not done during low-power pause mode.

Low-power pause mode is entered when the audio is not playing and the backlight has been turned off. The low-power pause mode has 5-minute power-off timeout.

IMPROVEMENT: The low-power pause mode should wake up periodically to check the battery level.

1.4 Startup Screen

The graphics for the startup screen is taken from the file **SCREEN.SCR**. The size should be 8×132 bytes. If this file does not exist, the software goes to main menu directly.

If the file exists, the startup screen is shown for about 10 seconds, or until any key is pressed. After that the main menu is shown.



Figure 1.4: Startup Screen

The unit does not turn on if you quickly touch the power button. There is a small time limit of 0.25 seconds. If the press was too short, the unit will turn itself off again after one second.

If the backlight is not configured to be always off, it is on during the display of the startup screen.

1.5 Menu System

The whole audio book is built around a menu system. Only audio files that have been added to the menu system are playable. One file MENU.MNU describes the menu tree.

The playable menu entries specify a file name, a starting position, and an end position. The playback starts from the start position and continues until the end of the .ogg file. After that the player returns to menu.

A menu entry can also specify that the end position is used to end the playback. In that case the portion between the start and end positions are played and after that the player returns to menu. This can be used to play only a specific fraction of a file, for example one part of a larger story.

The verse entries are used to display the name of the current play position during playback.

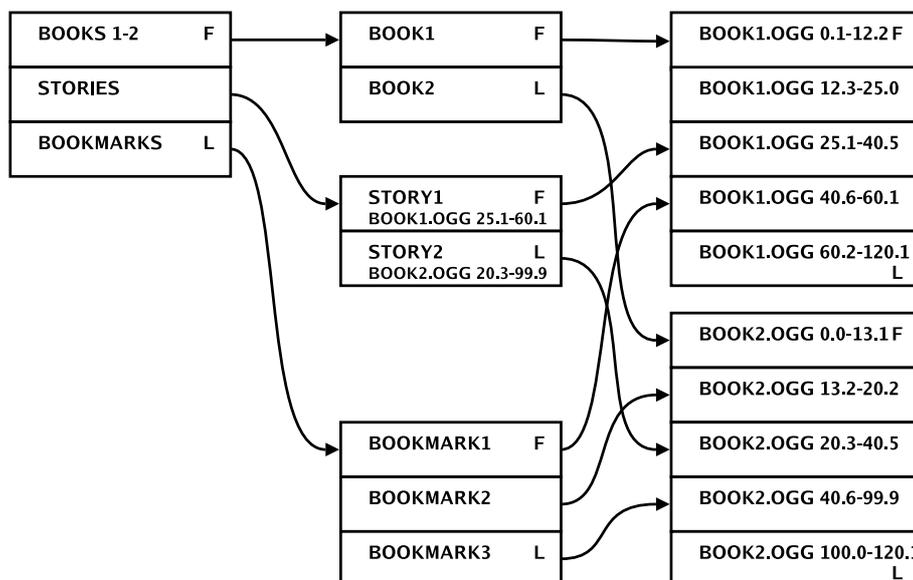


Figure 1.5: Menu Structure

Each entry is 64 bytes long. This includes a 42-character menu entry name, sub-menu indices, 8-character FAT filename, start and end times, and menu flags.

Bookmark menu entries have a filename starting with “:”, but they have special processing in the software: only bookmarks that exist are shown in the menu. You can also select the bookmark to continue browsing from the bookmarked verse.

Backlight timer menu entries have a filename starting with “!”, and you can have different backlight timer values by just modifying the menu entries.

See also `genmenu.c` and `menu.txt` for examples and comments.

The main menu can have a graphical top line from MAINMENU.SCR, 2×132 bytes. The battery symbol is drawn on top of the graphics. If the file is not found, the default graphics “MAIN MENU” is used.



Figure 1.6: Main Menu

Selecting an entry with NEXT or MODE/MENU button will advance in the menu tree. Pressing PLAY will start playing from the beginning of the current entry at any level, if the menu entry has the autoplay option.



Figure 1.7: Book Selection

After book selection you can select a chapter. At the lowest level you can select individual verses.



Figure 1.8: Chapter and Verse selection

You can set bookmarks in play mode and remove bookmarks in the bookmark menu. The bookmarked verse name is shown in the bookmark menu. You can press play to start playing, or you can press mode or next to start browsing from the bookmarked entry.

You can not enter the bookmark menu if there are no bookmarks. If you remove all bookmarks, you will be automatically returned to the main menu.

There is currently space for 28 bookmarks.



Figure 1.9: Main Menu

The current backlight timer setting is shown beside the backlight timer entry. ++ is shown if the backlight is always on, 00s is shown if the backlight is always off. Select the backlight menu to change the backlight timer setting.



Figure 1.10: Backlight Timer

Highlight the setting you want, then press mode, next, or play to select it. You will be automatically returned to the main menu.

Bookmarks, the volume setting and backlight timer configuration are saved to FLASH when the unit is turned off using the power key.



Figure 1.11: Play Mode

In play mode the software displays the current verse in the middle, the parent entry as the title, and indicators at the top. The indicators from left to right are: playing time, play or pause symbol, M for bookmark marked or BE for bookmark exists, 3D when EarSpeaker spatial processing is active (short press of the mode button selects between **off** and three different settings), the current volume, battery level, and keylock.

Bookmark indicator is cleared when play reaches the next verse.

1.6 User Interface

The user interface consists of 7 buttons: Power/Play/Pause, Volume down, Volume Up, Next, Previous, Mode, and Mark/Lock Both short press (press and release), and long press (press and keep pressed) key events are used.

Menu Mode	
Button	Operation
Pause/Play	If playable entry selected, start playing
Volume Up	One menu entry up
Volume Down	One menu entry down
Next	Enter submenu
Previous	Enter parent menu (leave submenu)
Mode	Enter submenu, Long press: return to play mode if play active
Mark/Lock	Delete bookmark, Long press: lock/unlock keys

Play Mode	
Button	Operation
Pause/Play	Toggle pause and play mode, Long press: Stop play
Volume Up	Volume up
Volume Down	Volume down
Next	Skip to end of entry, Long press: Fast forward
Previous	Skip to previous entry, Long press: Rewind
Mode	EarSpeaker select, Long press: activate menu but keep playing
Mark/Lock	Set bookmark, Long press: lock/unlock keys

Unless the keys are in locked mode, Long press of Pause/Play will stop play and return to menu. Long press of Pause/Play while in menu mode (and with unlocked keys) will turn the unit off.

To turn the unit off from play mode the user should release the key after the player has returned to menu and press the button again to turn off the unit.

The unit can be reset by continuously pressing the power key for longer than five seconds.

1.7 Flashing the Test Software through USB

The book software can be programmed through USB.

Attach the unit to USB, then turn on power with the power key. A mass storage RAM disk should appear.

If the RAM disk does not appear, the FLASH has already been programmed. You can ground NFCE (or disconnect it from FLASH) while turning on power to force RAM disk mode. Remember to restore normal operation when you get RAM disk to appear.

Copy VS1000_B.RUN and the image file (BOOK256M.IMG) to the RAM disk. Then detach the unit. The unit now programs the software to FLASH. After this is done, it will turn the unit off.

Now attach the unit to USB and turn it on using the power key. An uninitialized mass storage FLASH disk will appear. Then format it using 'quick format', it is a bit faster than full format.

Now you can copy the content: the Ogg Vorbis files, the menu file (MENU.MNU), startup screen (SCREEN.SCR), and optionally the graphic file for the main menu (MAINMENU.SCR). Because the graphic file formats are compatible you can also copy SCREEN.SCR to MAINMENU.SCR.

After copying has finished, select "Eject Disk" or "Remove Safely" from Windows, then detach the unit. The startup screen should appear, but you need to reset or restart the system for normal operation.

1.8 Flashing the Test Software Through UART

You can also program the firmware through serial port. Programming through the serial port is often used in software development, and only step 3 is used, because it leaves the FLASH disk contents unchanged.

1. Power up with flash disabled, then enable flash.
2. Use nandtools to init 256M FLASH.
 - (a) Use command 120, set 90ns, type 3, blocksize 8, flashsize 19.
 - (b) If you want to erase old content, use command 11 to erase these blocks one at a time.
0x100, 0x200, 0x300, 0x400, 0x500, 0x600, 0x800, 0x900, 0xa00
 - (c) Press ctrl-C.
3. Run flashbook.bat to program the firmware, then press ctrl-C
4. Connect the USB, then power up. Note that the firmware requires you to press it for a quarter of a second.
5. After a while the mass storage will appear, format the disk using quick format, then copy the content.
6. After copy select "eject" and wait 2 seconds. You can now detach USB.
7. The start screen should appear. Now reset the unit.
8. Programming is ready, you can press power to start the unit.

1.9 Example Files

The following example files are included:

VS1000_B.RUN	Programmer when flashed through RAMDISK
BOOK256M.IMG	FLASH Image for 256MB FLASH
flashbook.bat	Programs the image through UART using vs3emu
flasher.bin	The executable for previous.
flash.cmd	The command file for previous.
GENE0107.OGG	Audio file used by the example menu.mnu
RUTH0102.OGG	Audio file
sinemono.ogg	Audio file, mono test
screen.scr	Example startup graphics
menu.mnu	Example menu
genmenu.c	Converts a text file to menu format
mnu2txt.c	Converts menu files back to text format
menu.txt	Source file for the menu generator

menu.txt and genmenu.c also contain comments about the menu format.

2 Changes

Version 0.9

- **IMPORTANT: the menu format is changed: file and entry names have been swapped.**
- Added `mnu2txt.c` to convert a menu file back to text file.
- Fixed time calculation in `genmenu.c` . Rounding errors occurred when high and low parts of the time value were converted separately from floating point to integer.
- Added optional input and output filename parameters to `genmenu.c` .
- Used the whole book of Genesis in the menu example.
- Added **entry** keyword to `genmenu.c` to enable referencing verse entries while playing only parts of files.
- Story Index / Topic Index / Bible in a Year play all entries (see example `menu.txt`). The parent entry can't have autoplay. Both title and verse displays are updated.
- Verse names are shown in the bookmark menu.

Version 0.8

- Programming instructions updated.
- Low-power pause mode is not entered when backlight is on.

Version 0.7

- Menu and player modes can have graphical top line. The 2×132 -byte graphics is read from `MAINMENU.SCR` . If the file does not exist, a default MAIN MENU graphics is used. You can also copy `SCREEN.SCR` to `MAINMENU.SCR` to test the feature.
- Mode key can be used in addition to the Next key to enter a submenu.
- A menu generator (source code in `genmenu.c`) now reads a text-format menu description (`menu.txt`) and automatically generates references to submenus.
- Now checks if a bookmark to a specific entry exists, and displays "BE" to notice the bookmark already exists.
- Fixed a bug in saving of settings: sometimes if you saved settings with no bookmarks, this entry was always restored at power-up.