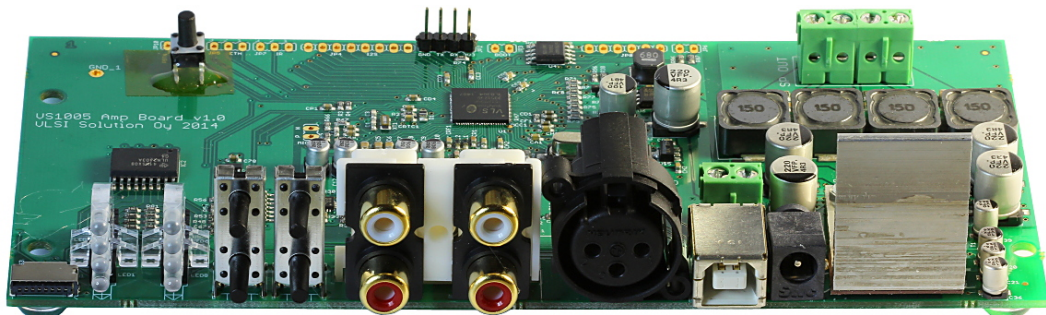# VS1005 AMP BOARD

User's Guide

All information in this document is provided as-is without warranty. Features are subject to change without notice.

Revision History			
Rev.	**Date**	**Author**	**Description**
1.01	2016-03-18	HH	Minor updates to document.
1.00	2016-03-17	HH	Initial release.

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1 Introduction

The VS1005 Amp Board is an application development board for VS1005. It features a class D amplifier for direct connection to speakers or speaker elements. The board has connectors for analog and digital inputs and outputs as well as speaker outputs. The board also features two columns of LEDs and buttons for a user interface.

Possible applications

- Active speaker with crossover implemented by the firmware for two speaker elements.
- Stereo amplifier with equalization filters.
- Any kind of customized audio media player.

The VS1005 Amp Board is a speaker development board with the VS1005 integrated circuit and a class D amplifier.

Its features are as follows:

- 8 LEDs and 4 buttons for user interface
- Analog XLR input and stereo RCA input with firmware-controllable voltage range select (input gain)
- Amplifier output for speakers or speaker elements (2x40 W to 8 Ω load, 2 x 70 W to 4 Ω load, bridged mode possible 1 x 135 W to 2 Ω load)
- Coaxial digital input and output (no audio driver for input yet)
- USB connection for firmware update and/or parameter adjustments
- microSD socket for audio data, firmware updates, data exchange, etc.
- Supply voltage from 7 V to 26 V (DC), center positive.
- Mounting holes, Solder points for additional interfaces and peripherals, such as IR receiver, microphone, UART, I2S, FM radio antenna
- Supports VS1005, VS1205 and VS8005 devices
- Open source VSOS kernel and device drivers, and example firmware
- Supported by VSIDE development tools

2 Definitions

B Byte, 8 bits.

b Bit.

Ki "Kibi" = 2^{10} = 1'024 (IEC 60027-2).

Mi "Mebi" = 2^{20} = 1'048'576 (IEC 60027-2).

Gi "Gibi" = 2^{30} = 1'073'741'824 (IEC 60027-2).

VS_DSP VLSI Solution's DSP core.

VSIDE VLSI Solution's Integrated Development Environment, available for free download at *http://www.vlsi.fi/en/support/software/vside.html* .

VSOS VLSI Solution Operating System. A real-time, multitasking operating system specifically designed for the VS1005 environment.

W Word. In VS_DSP, instruction words are 32-bit and data words are 16-bit wide.

3 Prerequirements

The following prerequirements need to be met.
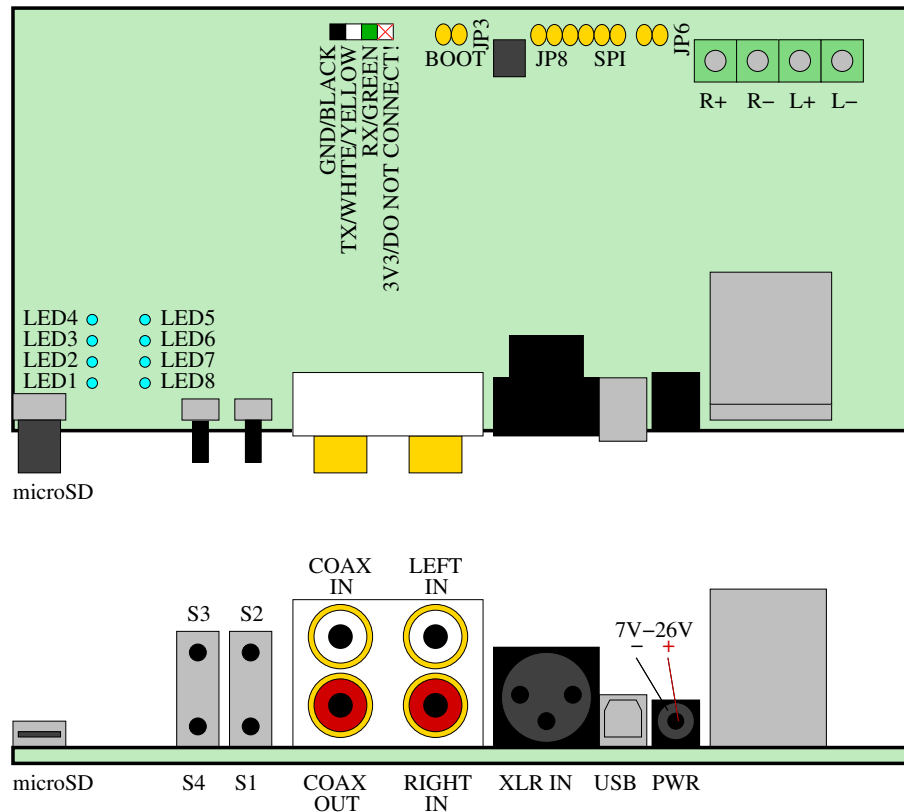
3.1 Hardware Prerequirements

Figure 1: VS1005 Amp Board.

The following hardware is required:

- The VS1005 Amp Board v1.0 or newer, as shown in Figure 1, is required.
- Power Supply (not included). VLSI recommends a standard laptop DC power supply, such as 12 V / 2 A or 20 V / 90 W.
- UART Cable. Connect the UART cable as follows: Black to GND, White/Yellow to TX, Green to RX. Do *not* connect Red 5 V to 3V3! This cable can be used for debugging and running the VSOS Shell.
- USB Cable. This cable can be used to load new applications to the board using USB Mass Storage Protocol.
- microSD card. Used for external file access, like playing media files.

Note:
As of 2016-03-15, there still doesn't exist an coaxial digital input driver for VSOS.

3.2   Software Prerequirements

The following software is required to develop a new firmware:

- VLSI Solution's Integrated Development Environment VSIDE, available for free download at *http://www.vlsi.fi/en/support/software/vside.html* .

- A terminal emulation program. See the *VS1005 VSOS UART Shell Environment* document for more details.

- A text editor.

3.3   Useful Resources

There are many places from where to get information on the Amp Board, VS1005, VSIDE, VSOS, and audio.

- Amp Board main page:
  http://www.vlsi.fi/en/support/evaluationboards/vs1005ampboard.html contains information on the Amp Board as well as links to other resources.

- Latest Amp Board Firmware release:
  http://www.vsdsp-forum.com/phpbb/viewtopic.php?f=13&t=1849 contains the latest Amp Board firmware release, along with instructions and other links.

- VSIDE:
  http://www.vlsi.fi/en/support/software/vside.html is the main page for VLSI Solution's Integrated Development Environment VSIDE which is free to download and use.

- VS1005 Applications page:
  http://www.vlsi.fi/en/support/software/vs1005applications.html contains the newest version of the VSOS operating system, as well as system root image files and documentation. Some very useful documents in this package to read are:

  - *VS1005 VSOS UART Shell Environment* for details on how to use the VSOS Shell.

  - *VS1005 VSOS Audio Subsystem* for a detailed explanation on the how the audio drivers work under VSOS.

- VSDSP Forum:
  http://www.vsdsp-forum.com/ is a place where you can place questions about the VS1005 Amp Board under the *VS1005 and VSOS Software* subforum.

4 Using the Amp Board

When the Amp Board is started up without any keys pressed, it will run the default Firmware (Chapter 4.1). Depending on which keys are pushed, different configurations from S:CONFIG.TXT are selected.

4.1 No Keys Pushed: Play Audio Files, Enter VSOS Shell

When started, VSOS loads and starts from a non-file system portion of the 2 MiB external SPI Flash Memory. It then then executes system disk file S:CONFIG.TXT from the FAT file system portion of the SPI Flash Memory, which contains the following default actions:

- Loads Amp Board-specific configuration additions. For some interesting definitions you might need when programming, have a look at the source code of the VSIDE Solution AmpBConf. The software is available on the microSD card provided with the Amp Board.
- Starts SD driver and mounts microSD card as drive D: if available.
- Tries to run D:UPDATE.DL3 if available (for later update compatibility).
- Starts required audio drivers.
- Starts UART in/out driver.
- Tries to run D:AUTOEXEC.DL3 if available.
- Plays all audio media files from main directory of D:. As a default, there is one 30-second media clip on the drive. Push either S1 on the board or Ctrl-C in your terminal emulation program to skip playing the file.
- Starts the VSOS UART Shell.

The output should look approximately as follows:

```
Hello.
VSOS 3.27 build Mar 15 2016 14:29:47
VLSI Solution Oy 2012-2016 - www.vlsi.fi

Starting the kernel..
Starting Devices...
External SPI Flash

Installed system devices:
S: SPI Flash c814, handled by FAT.
Load drivers, config 0...
Driver: AMPBCONF...
Driver: SDSD... D: SD card in SD mode

Driver: D:UPDATE.DL3... E'D:UPDATE.DL3 not found'
 not loaded
Driver: AUODAC...
```

```
Driver: AUIADC...   Input 0x0880  Rate 48000
Driver: AUOSPDA...
Driver: UARTIN...
Driver: RUN... E'D:AUTOEXEC.DL3 not found'

Driver: RUN...
Driver: RUN... PlayFiles D:*
Open file 1...
Playing 'TestFile.mp3' from device SD/SD Card...

Driver: S:SHELL.AP3...
VSOS SHELL
S:>
```

You may reset the board by pushing Ctrl-C three times from your terminal emulation
program.

4.2 S1 Pushed: Show Amp Board System Drive on USB

If S1 is pushed when booting, the Amp Board External SPI Flash system drive is shown
on USB as a mass-storage device. In this mode, you may edit the system configuration
text file CONFIG.TXT on your PC, and copy new programs to the SYS/ folder of the
drive. If you are developing software using VSIDE, you may also define the drive for
automatic deployment so that VSIDE automatically copies your software to this drive
after compiling a project.

It is *highly recommended* to study the text file CONFIG.TXT on this drive to better un-
derstand how the VSOS boot process works.

The output should look approximately as follows:

```
Hello.
VSOS 3.27 build Mar 15 2016 14:29:47
VLSI Solution Oy 2012-2016 - www.vlsi.fi

Starting the kernel..
Starting Devices...
External SPI Flash

Installed system devices:
S: SPI Flash c814, handled by FAT.
USB publishing disk: SPI Flash c814.
Size 1.9 MB.
SCSI START
BRST
BRST
```

You may reset the board by pushing Ctrl-C once from your terminal emulation program.
Remember to first *Safely Remove You Drive* from your operating system before doing
this, or you may break your file system!

4.3 S1+S2 Pushed: Show Amp Board's microSD Card on USB

If S1 is pushed when booting, the Amp Board microSD Card contents are shown on USB as a mass-storage device.

The output should look approximately as follows:

```
Hello.
VSOS 3.27 build Mar 15 2016 14:29:47
VLSI Solution Oy 2012-2016 - www.vlsi.fi

Starting the kernel..
Starting Devices...
External SPI Flash

Installed system devices:
S: SPI Flash c814, handled by FAT.
Load drivers, config 5...
Driver: AMPBCONF...
Driver: SDSDMONO... S: SD card in SD mode
E'SDSDMONO not found'

USB publishing disk: SD/SD Card.
Size 3796.0 MB.
SCSI START
BRST
BRST
```

You may reset the board by pushing Ctrl-C once from your terminal emulation program. Remember to first *Safely Remove You Drive* from your operating system before doing this, or you may break your file system!

4.4 S2 Pushed: Analog Audio In/Out Demo

If S1 is pushed when booting, the Amp Board Demo application AMPBDEMO.DL3 is loaded. This application reads audio from the RCA analog audio inputs and sends it to the speaker outputs.

The user may push S3 and S4 for volume up and down, respectively. LEDs indicate the current volume level in 3 dB steps.

The output should look approximately as follows:

```
Hello.
VSOS 3.27 build Mar 15 2016 14:29:47
VLSI Solution Oy 2012-2016 - www.vlsi.fi

Starting the kernel..
Starting Devices...
External SPI Flash
```

```
Installed system devices:
S: SPI Flash c814, handled by FAT.
Load drivers, config 2...
Driver: AMPBCONF...
Driver: AUODAC...
Driver: AUIADC...   Input 0x0880  Rate 48000
Driver: AUOSPDA...
Driver: UARTIN...
Driver: RUN...
Driver: RUN...
Driver: RUN...
Driver: RUN... Amp Board Demo
```

You may exit the demo and enter the VSOS Shell by pushing Ctrl-C in your terminal emulation program.

In the Shell, you may reset the board by pushing Ctrl-C three times from your terminal emulation program.

4.5   S3 or S4 Pushed: Future Expansion

It is possible to create configurations for keys S3 or S4. In this release, they are not used.

5   Updating/Restoring the Amp Board

This Chapter explains how to update an Amp Board, or restore a non-working Amp Board to life.

5.1   Updating/Restoring the VSOS Kernel (VSOS 3.27 or Newer Required)

If you don't get any boot messages (like the *Hello. VSOS 3.27* etc.), or if you want to update to the latest VSOS Kernel, do the following:

- Start up the Amp Board with the two JP3 / BOOT pins shorted (see Figure 1 for location of JP3 / BOOT). You should see no boot message.

- Unshort the JP3 / BOOT pins.

- Connect the USB-UART cable, then start up VSIDE on your PC. Now do this:

    - Select File -> New -> Project/Solution
    - Select Create new solution based on template -> VS1005 Solution
    - Name the solution e.g. VSOS_abc (where abc is e.g. 327), then push Next
    - Select VSOS3 Kernel a.bc for VS1005G Internal or External Flash (where a.bc is e.g. 3.27), then push OK
    - Select Build -> Rebuild Project
    - After successful compilation, select Project -> Prommer/Flasher Utility
    - Select VS1005G External SPI Flash Prommer, then Next
    - Default image file name eeprom.img is good, push Next
    - Push Start to start the prommer
    - If you get an serial port failure, push Settings, then Autodetect. You should now get a window that says Chip Type: VS1005, Initial speed: 115200. Push Ok, then Close.
    - Start promming the kernel by pushing Start.

If you have done everything correctly, you should see approximately the following:

```
Starting VS1005g external SPI Flash prommer v2014-01-14...
  Serial Flash RDID: manufacturer c8, type 40, density 15
  Serial Flash REMS: c814

Opened map file "eeprom_e.map"
  Programming file "eeprom.img" to address 0x000000 (0)
    Erase 4 KiB sector  0 (   0 -    4 KiB), ok. Writing data .
[... similar lines removed for brevity ...]
    Erase 4 KiB sector  8 (  32 -   36 KiB), ok. Writing data .
  Ok
Map file "eeprom_e.map" closed
Finished, rebooting. (Press Close/Cancel on VSIDE)
```

You may now restart the board by e.g. powering it down and up again.

5.2 Updating/Restoring the System Software

When you have the VSOS Kernel in order, you may now update the system software. To do this, do the following:

- Start the Amp Board by keeping S1 pushed. You should now see messages as shown in Chapter 4.2, *S1 Pushed: Show Amp Board System Drive on USB*. You should also see a drive on your PC with a capacity of slightly below 2 megabytes.

- If you haven't used the board before, or if the file system has crashed, you need to format the drive.

- Copy the System Root files of the current kernel. You will find them at the link provided in Chapter 3.3, *Useful Resources*.

- Copy root/CONFIG.TXT from the VS1005 Amp Board software package to the main directory of the drive.

- Copy the contents of root/sys/ to the SYS/ directory of the drive.

- Now Safely Remove the Drive, and restart the AmpBoard.

Now the Amp Board is fully updated, and it should act as explained in Chapter 4, *Using the Amp Board*.

6 Contact Information

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For confidential technical discussions, contact
support@vlsi.fi