VS1011e - MP3 AUDIO DECODER Programming Howto v1.1

Andreas Hagmann, ahagmann@ecs.tuwien.ac.at

May 23, 2013

Abstract

This article gives a short introduction how to interact with the VS1011e mp3 decoder chip (Especially in conjunction with the *SmartMP3 board by Microelectronika*). It assumes a working SPI interface and does not cover basic SPI communication.

The whole article is based on the VS1011e datasheet [2] and the SmartMp3 manual [1].

1 Pin Description

The following table shows the pins available at the SmartMP3 board. All devices share the same SPI bus and are selected via the corresponding (low active) chip select signal.

Pin Name	Description
MMC-CS	SD Card chip select for SPI interface
MP3-RST	reset pin for MP3 decoder
MISO	SPI master in slave out (is not used in our Application)
MMC-CD	SD Card detect
MP3-CS	MP3 decoder chip select for SPI control interface
SCK	SPI clock
MOSI	SPI master out slave in
DREQ	MP3 decoder data request
BSYNC	MP3 decoder chip select for SPI data interface
DCLK	not needed
SDATA	not needed
VCC	power supply +5V
GND	power supply ground

The *MISO* pin cannot be used because the board always drives this pin and therefore it would affect the functionality of the SPI bus.

2 Write Data

The VS1011e is connected to the microcontroller via a *SPI* bus. In the sequel *send* means to send data through the SPI interface of the microcontroller.
Before sending any data to the VS1011e, it has to be made sure that the chip is ready to receive new data. The VS1011e signals with a *high* DREQ pin, that it can receive at least 32 bytes data or 1 *SCI* command. SCI (Serial Control Interface) commands are used to control the VS1011e.

2.1 SCI Commands

The VS1011e SCI registers are 16 bit wide, hence each write operations tranfers 2 bytes, the MSb is always sent first. A register overview is given in Figure 2.1, a detailed description of each register starts in the datasheet [2] on page 30.
To write to a VS1011e register execute the following steps.

SCI registers, prefix SCI_					
Reg	**Type**	**Reset**	**Time**[1]	**Abbrev[bits]**	**Description**
0x0	rw	0	70 CLKI[4]	MODE	Mode control
0x1	rw	0x2C[3]	40 CLKI	STATUS	Status of VS1011e
0x2	rw	0	2100 CLKI	BASS	Built-in bass/treble enhancer
0x3	rw	0	80 XTALI	CLOCKF	Clock freq + multiplier
0x4	rw	0	40 CLKI	DECODE_TIME	Decode time in seconds
0x5	rw	0	3200 CLKI	AUDATA	Misc. audio data
0x6	rw	0	80 CLKI	WRAM	RAM write/read
0x7	rw	0	80 CLKI	WRAMADDR	Base address for RAM write/read
0x8	r	0	-	HDAT0	Stream header data 0
0x9	r	0	-	HDAT1	Stream header data 1
0xA	rw	0	3200 CLKI[2]	AIADDR	Start address of application
0xB	rw	0	2100 CLKI	VOL	Volume control
0xC	rw	0	50 CLKI[2]	AICTRL0	Application control register 0
0xD	rw	0	50 CLKI[2]	AICTRL1	Application control register 1
0xE	rw	0	50 CLKI[2]	AICTRL2	Application control register 2
0xF	rw	0	50 CLKI[2]	AICTRL3	Application control register 3

Figure 1: VS1011e Register Overview

- Activate the SPI control interface by pulling MP3-CS to low.
- Send *write* opcode (0x02).
- Send the register address.
- Send the higher data byte.
- Send the lower data byte.
- Release the SPI control interface by setting MP3-CS to high.

3 Initialisation

To initialize the VS1011e for playing mp3 streams, the following steps are necessary.

- **Init pins**: Set MP3-RST, MP3-CS and BSYNC to *high*.
- **Hardware reset**: Put a negative pulse on the MP3-RST line.
- **Set clock frequency**: Write 12500 into the CLOCKF (0x03) register.
- **Set native mode with streaming**: Set bit 6 (SM_STREAM) and 11 (SM_SDINEW) in the MODE (0x00) register.
- **Set volume**: Write an appropiate value (e.g. 14000) into the VOL (0x0b) register.

4 Sine Test

To test the VS1011e without streaming mp3 files, one can use the buildin *sine test*. To activate the test perform the following steps.

- Enable tests by setting bit 5 in the MODE register.

- Activate the SPI data interface by pulling BSYNC to low.
- Send this sequence as raw data: 0x53, 0xEF, 0x6E, 0xCC, 0x00, 0x00, 0x00, 0x00
- Release the SPI data interface by setting BSYNC to high.

The sine test ist stopped by these steps.

- Activate the SPI data interface by pulling BSYNC to low.
- Send this sequence as raw data: 0x45, 0x78, 0x69, 0x74, 0x00, 0x00, 0x00, 0x00
- Release the SPI data interface by setting BSYNC to high.
- Disable tests by deleting bit 5 in the MODE register.

5 Send mp3 Data

After initialisation the VS1011e is ready to decode mp3 streams. It signals with a *high* DREQ pin, that it can receive 32 bytes of data. Sending data requires the following steps.

- Activate the SPI data interface by pulling BSYNC to low.
- Send 32 bytes raw data (No SCI write sequence is needed.).
- Release the SPI data interface by setting BSYNC to high.

For more details look into the datasheet [2].

References

[1] MikroElekronika. Smartmp3 manual. http://www.mikroe.com/eng/downloads/get/1109/smartmp3_manual_v101.pdf. [online; last visit 26.05.2011].

[2] VLSI Solution Oy. Vs1011e - mp3 audio decoder. http://www.vlsi.fi/uploads/media/vs1011_01.pdf, 2009. [online; last visit 27.04.2011].