

MP3orator/Xtend

Industrial Digital Audio Player

Datasheet Rev.: 1.0
Date: 12.11.2009

Features

- Atmel **ATmega644P** RISC CPU @ 6MHz
- VLSI **VS1011E** MP3/WAV Decoder
- Decodes MPEG 1 & 2 audio layer 3 (ISO 11172-3), WAV and PCM files
- Supports VBR (variable bitrate) for MP3
- High-quality stereo DAC with no phase error between channels
- Active de-click circuit on audio outputs
- Stereo earphone driver capable of driving a 300ohm load
- **SDcard** removable storage device, on SPI
- **4 optically coupled** digital inputs
- **Onboard programmability** with rotary switch, pushbutton and LED
- Remote controlled via RS-232, or 4 digital inputs
- Operating Voltage: **5...32VDC**
- Pre-programmed with application firmware for standalone operation. Controlled via digital inputs and/or serial port control. FAT16 with multi-level directories supported.

Ordering Information

Art.-No. 01.0142

MP3orator/Xtend, OEM board

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Specifications

AUDIO

Decoder Type	VLSI VS1011E
Clock	14.7456 MHz
Decoded Audio Formats	MPEG 1 & 2 audio layer 3 (ISO 11172-3), WAV and PCM
DAC Resolution	16 bits
THD	0.1%
Dynamic Range	88dB
Output Voltage	1.6...2.1VPP @ 30 Ohms

CPU

Type	Atmel ATmega644P 8-bit RISC
Clock	6 MHz

STORAGE DEVICE

Type	Sdcard, FAT16
Operating Mode	SPI

I/O

Serial	RS-232
Parallel	4 optically coupled digital inputs 1 open-drain output

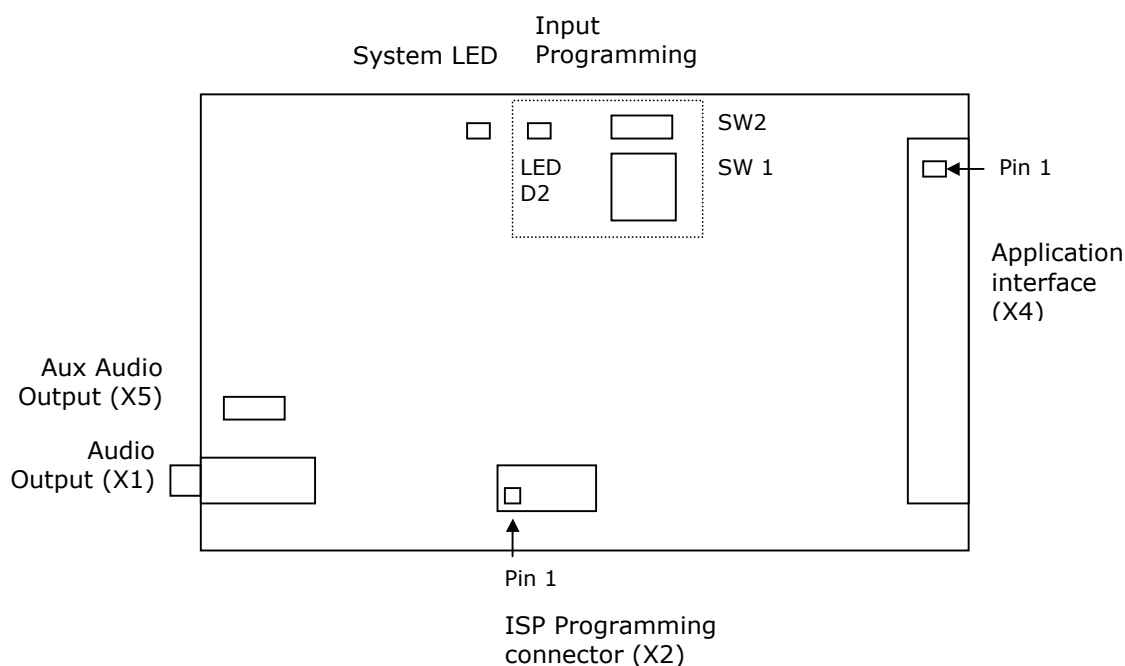
Power Supply

Requirement	5 ... 32VDC, max. 40mA
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Mechanical

Size (L x W)	50 x 80 mm
Weight	60 g

Connector Specifications



Application Interface

X4: Application				
No.	Signal	Type	Description	Standard Firmware Function
1	INP1	IN	Digital Input Port 1	Play File 0001.mp3 ¹
2	INP2	IN	Digital Input Port 2	Play File 0002.mp3
3	INP3	IN	Digital Input Port 3	Play File 0003.mp3
4	INP4	IN	Digital Input Port 4	Play File 0004.mp3
5	INP5/OUT	IN/OUT	Digital Input Port 5/Busy Output	Play File 5/BUSY signal, active low (OUT) ²
6	INP-COM	POWER	Common for optocouplers IN1...5	
7	RS-232/TXD	OUT	RS-232 Port, transmit data	Serial Command Interface
8	RS-232/RXD	IN	RS-232 Port, receive data	
9	GND	POWER	Power Ground	
10	VIN+	POWER	5...32VDC Supply Voltage	

Audio

X5: Aux Audio			
No.	Signal	Type	Description
1	AGND	POWER	Audio Signal Ground
2	RIGHT	OUT	Right channel audio output
3	LEFT	OUT	Left channel audio output

¹ This is the default file assignment. Assignments for all inputs can be modified with SW1 and SW2, as described on page 4.

² The function of this signal is determined by hardware configuration of J1. Per default, this signal is the BUSY output.

ISP Programming Interface

X1: Programming			
No.	Signal	Type	Description
1	MISO	OUT	SPI bus
2	+3.3V	POWER	Digital power
3	SCK	IN	SPI bus
4	MOSI	IN	
5	RESET	IN	CPU Reset Input/Output
6	GND	RESET	Signal and power ground

Device Operation

Power Supply

The MP3orator module can be powered from a regulated 5...32VDC source through X4, pins 10 and 9.

Signal Levels

All input signal levels present on the Application Interface connector X4 are 24V logic levels. Inputs are activated by applying a 24VDC voltage between the input terminal (INP1...4) and INP-COM.

Signal levels on serial interface conform to RS-232 standard.

BUSY-OUT is an open-drain output, capable of sinking 0.6A @25V max.

Audio File Assignment Programming

Sound clips can be assigned to input ports when unit is in idle state (i.e. no file is being played).

1. Press SW2. LED D2 starts flashing
2. Select input number (0...4) with SW1 rotary switch
3. Press SW2. LED D2 stays on
4. Select sound file number (see below) with SW1 rotary switch
5. Press SW2. LED D2 goes off.

Special cases:

- Sound file number 0: This input will play a randomly selected file (as with PM command)
- Sound file number 1: This input will play all files continuously (as with PA command)

Sound File Naming Convention

All sound files, that are to be played by digital inputs, shall be named with numbers, e.g. '0001.mp3', '0002.mp3', ... '0015.mp3', and reside in the root directory of the SDcard.

Serial Command Interface

The serial interface can be connected to a host PC with a terminal application. The communications parameters are:

```
9600 bps, 8 databits, 1 stopbit, no parity
```

The available commands are described from page 5 onwards.

Startup

Normal Startup

After power-on, the BUSY signal will be asserted and the MP3orator module will send initialization messages over the serial port as follows:

```
INIT: MP3orator/Xtend Vx.y  
INIT: DSP HW  
INIT: DSP SW  
INIT: IDE  
INIT: Ready
```

After the 'Ready' message, the BUSY signal will be deasserted, and the module is ready to receive commands over the serial interface or via the digital inputs.

Startup Errors

ERROR: IDE init failed, need Reset

SDcard not inserted, not properly formatted or defect.

Playback Control Commands

PF:	Play File
Argument:	Filename
Description:	Plays the *.mp3 file with name given in argument.
Response:	PLAY: <filename>
Errors:	ERROR: not found.
	Filenames must be 1...8 characters long, conforming to 8.3 standard. Files are searched in the current directory (see CD command for further information on directories). Extension must not be entered in the argument.
PN:	Play Number
Argument:	1...4-digit file number
Description:	Plays *.mp3 file with name corresponding to number given in argument. The number must be in the range 0...9999. The number argument is padded with '0' characters to a 4-digit filename. This filename is then split into path and filename as follows: Digit 1: name of first directory level Digit 2: name of second directory level Digits 1-4: filename
Example:	The file 1023.mp3 will be found in the directory \1\0\1023.mp3
Special Case:	When the file number is 5 digits long, the file will be searched in the root directory.
Response:	PLAY: <filename>
Errors:	ERROR: not found.
PR:	Play Number in Current Directory
Argument:	1...4-digit file number
Description:	Plays *.mp3 file with name corresponding to number given in argument. Number must be in range 0...9999. The number argument is padded with '0' characters to a 4-digit filename. This filename is then searched in the current directory.
Response:	PLAY: <filename>
Errors:	ERROR: not found.
PM:	Play Random
Argument:	(none)
Description:	Starts playback of a randomly selected file. File number is in the range as specified by the SR command.
Response:	PLAY: <filename>
PA:	Play All
Argument:	none or 0: Plays from first to last file in directory, stops after last file

	bit 0 set: wraps at end of directory bit 1 set: starts at current file.
Description:	Plays all files in sequence, numbered 1...n (as set with SR)
Response:	PLAY: <filename>
Errors:	ERROR: not found.
SP:	Stop Playback
Argument:	(none)
Description:	Stops playing of present audio file. Player will return to idle state.
Response:	ACTION: stopped.
PS:	Pause Playback
Argument:	(none)
Description:	Pauses playing of present audio file. Player will return to paused state. Audio playback may be resumed with CO command.
Response:	ACTION: paused.
CO:	Continue Playback
Argument:	(none)
Description:	Resumes playing of present audio file at file position where it has been paused.
Response:	PLAY: <filename>: <Bytes played>: <Bytes Total>.
SC	Show Clip Table
Argument:	(none)
Description:	Shows current clip table settings (defaults: 0000.mp3, 0001.mp3, 0005.mp3) for the digital inputs.
Response:	Clip Table: 1: 0001.mp3 2: 0002.mp3 3: 0003.mp3 4: 0004.mp3 Fader: 100ms/2dB Random: 16
FO:	Fade Out
Argument:	(none)
Description:	Fades out the currently played audio file and stops playback when the lowest volume level is reached. The fade out speed can be defined with the FT command.
Response:	ACTION: Fading out... ACTION: End of File.
FT:	Set Fade Out Time
Argument:	1...5-digit numeric value
Description:	Sets the fade out time in milliseconds per 2dB volume step.
Response:	SYSTEM: Fade Interval set to xxxx ms/2dB.
SR:	Set Random Max
Argument:	Highest clip number (1...9999) Command without argument shows the current setting.
Description:	Sets the highest file number for random play. The command PM then plays all files in the specified range.
Response:	RANDOM: nnnn

ST:	Show Player Status
Argument:	(none)
Description:	Displays player status.
Response:	Idle Playing Paused Error

File Handling Commands

DI:	Directory Information
Argument:	(none)
Description:	Displays directory listing of current directory.
Response:	DIR: path: <path of current directory> DIR: <filename> ...

FI:	File Information
Argument:	(none)
Description:	Displays file information of currently playing or preset *mp3 file.
Response:	FILE: <filename>>: <Bytes played>: <Bytes Total>

CD:	Change Directory
Argument:	Directory name
Description:	Changes the current directory to the one given in the argument. Directory name must be 1...8 characters long. Wildcards are not allowed. Special characters: .. changes to the parent directory.
Restriction:	A maximum of 4 directory levels is currently supported.
Response:	DIR: <current directory>
Errors:	ERROR: not found.

GD:	Get Current Directory
Argument :	(none)
Description:	Displays the current working directory.
Response:	DIR: <current directory>

Sound Control Functions

VU :	Volume Up
Argument :	(none)
Description:	Increases playback volume by 2dB.
Response:	VOL: <hex value>

VD:	Volume Down
Argument:	(none)
Description:	Decreases playback volume by 2dB.
Response:	VOL: <hex value>

VS:	Volume Set
Argument:	2-digit Hex value
Description:	Sets playback volume level to hex value given in argument. Value 0 corresponds to maximum volume or 0dB, value BF corresponds to minimum volume, value FF switches off the audio part of the VS1011 decoder.

Response: VOL: <hex value>

Maintenance Functions

UD:	Update Flash
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Argument: (none)

Description: Invokes firmware upload mode.

Response: Confirm Firmware Upload.

Enter Y to confirm, or any other character to abort. Please refer to the following chapter for instructions on download process.

Loading of New Firmware to MP3orator

Prerequisites

1. Image file with firmware in Intel-Hex format (*.hex)
2. Download tool for PC: `flashloader.exe`
3. Serial RS-232 connection to PC.

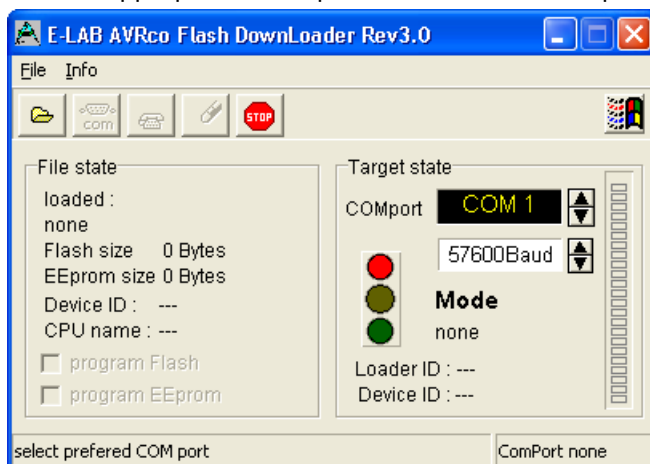
Procedure

Hardware Setup

1. Connect MP3orator/Xtend module to PC.
2. Apply power to the module

Prepare PC software

3. Download firmware file (*.hex) from support website or receive it via email, and store it on PC.
4. Start a terminal program on the PC, set to 9600bit/s, 8 databits, 1 stopbit, no parity.
5. Check serial connection by entering the 'ST' command.
6. Enter the command 'UD' and confirm message with 'Y' to invoke the bootloader on the MP3orator/Xtend module.
7. When the System LED on the MP3orator/Xtend lits, close the terminal connection in order to release the COM port.
8. Start the download tool `flashloader.exe` on the PC.
9. Set the appropriate COM port and transmission speed to 9600 Baud:



10. Open the file selection dialog in the menu „File – Open File...“, select the firmware imagefile and select „Open“.
11. Click the button „com“. The status display on the right side should now show „Target connected“.
12. Start downloading by clicking on the “Telephone” button. The status display will now show „programming“, and the progress bar fills up. After the download is finished, the status message reads again „Target connected“.
13. Start firmware by clicking on the „Stop“ button.



Check for Successful Download.

4. Close the download tool
5. Open the terminal connection again and issue the 'SI' or any other command.

Appendix

Notice to Users

The intended use of the MP3orator/Xtend modules is described in this document. Other than the described uses are not permitted or only after consultation with the manufacturer.

MP3orator/Xtend modules are not authorized for use as critical components in life-support devices or systems.

Life-support devices or systems are devices or systems intended for surgical implantation into the body or to sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling and user's manual, can be reasonably expected to result in significant injury.

No complex software or hardware system is perfect. Bugs are always present in a system of any size. In order to prevent danger to life or property, it is the responsibility of the system designer to incorporate redundant protective mechanisms appropriate to the risk involved.

All MP3orator/Xtend modules are 100 percent functionally tested. Additional testing may include visual quality control inspections. Specifications are based on characterization of tested sample units rather than testing over temperature and voltage of each unit. MP3orator/Xtend modules may qualify components to operate within a range of parameters that is different from the manufacturer's recommended range.

Revision History

Revision	Date	Comments
1.0	12.11.2009	Initial Release