AT83SND2CMP3

User Guide

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AT89RFD-08 User Guide

Introduction

The AT83SND2CMP3 easily adds MP3 music playing feature to mobile phone or any type of application.

This product has fully integrated stand-alone:

- Hardwired MPEG I/II-Layer 3 decoder
- MP3-player control
- Stereo Audio DAC
- Mono Audio Power Amplifier for speaker control

This document describes the MP3 Player, the Machine-Machine Interface and how to communicate with UART link to remote control the MP3 player.

Associated Schematics Refer to schematics of an AT83SND2CMP3 implementation at the end of this document.

Typical MP3 Applications
- Mobile Phone,
- MP3-Player,
- PDA, Camera
- Car Audio/Multimedia
- Home Audio/Multimedia

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Section 2

Functional Description

The AT83SND2CMP3 is designed to be used as a slave device driven by an host controller via a UART connection.

2.1 Features

The AT83SND2CMP3 module provides:

- MP3 music playing capability
    - from Nand Flash (512Byte page size)
    - from MMC or SD card,
- Embedded FAT 12/16/32.
- The AT83SND2CMP3 can be remote controlled from an external Controller using standard commands such as:
    - Play, stop, pause, next, previous,
    - Select memory,
    - File System Navigation,
- System configuration (digital and analog sound settings, audio input and output selection,).
- USB mass storage capability from NF/MMC/SD connected to AT83SND2CMP3.
- File transfer (from/to host/Player memory) through UART.

2.2 Description of the Environment

List of system Interfaces:

Figure 2-1. General System Architecture

2.2.1   USB   AT83SND2CMP3 USB interface complies to the USB 2.0 Full Speed specifications.

The USB bus is used to download music using bulk transfer.

The system supports Mass Storage on the following platforms: Win98 with Atmel driver, Win2000/ME/XP. These platforms do not provide multi-drive (multiple USB Logical Unit) support, except Win2000 Service Pack 3 that allows multi-drive support.

2.2.2   SD/MMC Card   Memory cards are controlled by AT83SND2CMP3 and can be considered as removable disk drives: copying from any PC storage media to the memories is then possible.

Note: Only SD Card and MMC cards with block size of 512 bytes and compliant with Secure Digital Card Specification and MultiMediaCard System Specification Version 3.1 are accepted. SD card is used in 1-bit mode (like MMC card). 4-bit mode is not supported.

2.2.3   Audio Output   ■ Stereo Headset (32 Ohm)

■ Loud Speaker (8 Ohm)

2.2.4   Audio Input   An external mono audio input signal and an external stereo audio input can be connected to AT83SND2CMP3. Refer to AT83SND2CMP3 datasheet to connect audio mono auxiliary positive and negative input (AUXP and AUXN), and stereo Line-in input (LINEINL, LINEINR). Audio input are not disable during USB mass storage.

2.2.5   UART Link   The physical link between Remote Controller and AT8xC51SND2C is UART plus one or more signals for data link handshaking when needed. The default baudrate is 115200 bps (physical baudrate is 111 111 bps) and can be changed later with a special command.

2.2.6   Power Management   To prevent system malfunctions during periods of insufficient power supply voltage, AT83SND2CMP3 voltage supply shall be monitored by a voltage supervisor.

Note: Refer to Atmel Document 'External Brown-out Protection for C51 Microcontrollers with Active High Reset Input'.

■ Power supply requested in Player mode: 2.7V – 3.6V

■ Power supply requested in USB mode: 3.0V – 3.6V

■ Audio Power Amplifier voltage AUDVBAT for loud speaker shall be from 3.2V to 5.5V. Refer to AT83SND2CMP3 datasheet for specification.

The communication protocol provides POWERDOWN and WAKEUP commands to optimize the system power consumption.

2.2.7   Clock   AT83SND2CMP3 Frequency oscillator value: 16 MHz.

Section 3

Communication Protocol

The AT83SND2CMP3 is remotely controlled using simple 'user interface like' commands such as Play or Stop commands. The communication protocol provides an abstraction of the physical layer between the Remote Controller and the Player.

3.1 Communication Protocol

The communication protocol is a half-duplex protocol between a host Remote Controller and the AT83SND2CMP3 (Player) over a UART.

Note: In the following discussion, Remote Controller is considered as a 'master' and Player as a 'slave'.

3.2 Frame Format

All the commands at physical layer level shall respect the following frame format:

Figure 3-1 . Communication Protocol Frame Format
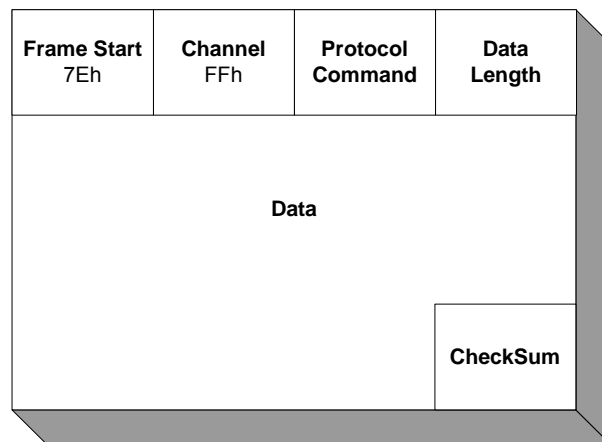
The frame format breaks down into the following information:

- *Frame Start* (1 byte): Synchronization character 7Eh
- *Channel* (1 byte): logical channel number (reserved and set to FFh)
- *Protocol command (*1 byte): refer to command set list.
- *Data Length* (1byte)*:* data length in byte excluding the Checksum byte.

- *Checksum* (1 byte)*:* Frame checksum: 8 least significant bit of the sum of: Channel + Protocol Command + Data Length + Data.

In the following discussion, the Channel parameter is set to FFh.

3.3 Remote Controller - AT83SND2CMP3 Command Set List

There are several command types:

- ■ *System Command*: these commands allow to configure the system.
- ■ *Player Command*: these commands allow to access all the Player's functions.
- ■ *File System Command*: these commands allow to navigate in selected memory: file and directory architecture for the Card Memory.
- ■ *Streaming Memory Driver Interface Command*: these commands allow the Remote Controller to stream MP3 music upon Player's requests.
- ■ *Custom Command*: these commands allow the Remote Controller to do specific requests.

Table 3-1 . System Command

Protocol Command	Command	Data	Description
SYSTEM_RESET	00h	No	Software reset the AT83SND2CMP3. There is no answer for this command. Refer to Player Reset section.
SYSTEM_CONFIG	01h	Yes	Configure the player in a pre-defined state
SYSTEM_GET_STATUS	02h	No	Asks the Player Status byte
SYSTEM_AUDIO_OUTPUT	03h	1 Byte	Select Player Audio Output: • Headset • Headset and Power Amplifier
SYSTEM_SELECT_MEMORY	04h	1 Byte	Select Memory on: • NandFlash (NF)AT83SND2CMP3 • Card (SD/ MMC) connected to AT83SND2CMP3 When FAT is mounted, FNA is set in Player's status (refer to Table 5-1) and SYSTEM_MOUNTED* frame is sent.
SYSTEM_SET_SOUND	05h	5 Bytes	Set digital sound and digital equalization. Refer to set sound command description
SYSTEM_POWER_DOWN	06h	No	Power Down the Player
SYSTEM_WAKEUP	07h	No	Wake-up the Player. Warning: this command requires AT83SND2CMP3 RXD line connected to INTO pin (P3.2) in hardware.
SYSTEM_USB_DETACH	08h	No	Ask the Player to perform an USB Mass Storage detach.
SYSTEM_USB_CONNECT	09h	No	Ask the Player to perform an USB Mass Storage PC Connection.
Reserved	0Ah	No	Reserved.
SYSTEM_VOLUME_UP	0Bh	No	Analog Gain control volume up
SYSTEM_VOLUME_DOWN	0Ch	No	Analog Gain control volume down

Protocol Command	Command	Data	Description
SYSTEM_PLAYER_MODE	0Dh	1 Byte	Set Player mode on selected memory: • Repeat / No Repeat • Play Single • Play Dir • Play Disk • Explorer Mode (see all file type for file transfer)
SYSTEM_AUDIO_INPUT	0Eh	1 Byte	Enable Player Audio Input • None - disable selected input • Mono Input • Stereo Input
SYSTEM_ENTER_HID_MODE	0Fh	No	Ask the Player to enter the HID mode: bridge USB - UART.

Table 3-2 . Player Command

Protocol Command	Command	Data	Description
PLAYER_PLAY	50h	No	If current file name is a MP3 file, play or resume pause selected MP3 file from Selected Memory. If current file name is a directory, enter this directory and select the first MP3. A new Play command is needed to play this new MP3 file.
PLAYER_STOP	51h	No	Stop playing current MP3 file
PLAYER_PAUSE	52h	No	Pause current MP3 file
PLAYER_NEXT	53h	No	Select Next MP3file on Selected Memory
PLAYER_PREVIOUS	54h	No	Select Previous MP3 file on Selected Memory
PLAYER_SETMARKERA	55h	No	Set A marker for repeat AB feature
PLAYER_SETMARKERB	56h	No	Set B marker for repeat AB feature
PLAYER_STOPAB	57h	No	Stop AB repeat mode
PLAYER_GET_TIME	58h	No	Get Playing time since beginning of the file.
PLAYER_GETINDEXNUMBER	59h	No	Get Number of file in current directory or root directory.
PLAYER_ENTER_ROOT_DIR	5Ah	No	Select the first MP3 files available in root directory.
PLAYER_SET_FILTER	5Bh	No	Set filter to have no directory seen.
PLAYER_GET_FILE_LIST	5Ch	No	Get file names list in current directory or root directory.
PLAYER_PLAY_INDEX	5Dh	Yes	Play file selected by index.

Table 3-3 . File System Command

Protocol Command	Command	Data	Description
FS_NEXT	60h	No	Select next file from delected memory
FS_PREVIOUS	61h	No	Select previous file from selected memory
FS_ENTER_DIR	62h	No	Enter selected directory
FS_EXIT_DIR	63h	No	Exit current directory
FS_GET_NAME	64h	No	Get name of selected file or directory on selected memory
FS_FORMAT	65h	No	Format in FAT16 on selected memory

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Protocol Command	Command	Data	Description
FS_FCREATE	66h	Yes	Create a file on selected memory
FS_FREAD_BLOCK	67h	Yes	Read data block to current created file
FS_FWRITE_BLOCK	68h	No	Write data block from selected file
FS_FWRITE_LAST_BLOCK	6Dh	No	Write last data block from selected file
FS_FCLOSE	69h	No	Read or write close current file transfer
FS_GETMEMFREESPACE	6Ah	No	Get memory free space available
FS_GETFILESIZE	6Bh	No	Get current file size
FS_GETFILEPOS	6Ch	No	Get current file position
FS_FDELETE	6Eh	No	Delete current selected File

Table 3-4 . Custom Command

Protocol Command	Command	Data	Description
AUDIO_SET_GAIN	91h	Yes	Set Audio Gain.
AUDIO_SET_PA_LP	92h	Yes	Set Power Amplifier mode for low power.
CUSTOM_UART_SET_BAUDRATE	93h	Yes	Change UART baudrate from Remote Controller.
CUSTOM_GET_SYS_VERSION	94h	no	Get Player version.
CUSTOM_SYSTEM_VOLUME	F0h	Yes	Set Analog Volume (master gain volume)
CUSTOM_PLAYER_GET_TOTAL_TIME	F1h	Yes	Get MP3 file playing total time length.
CUSTOM_PLAYER_FIRST	F3h	Yes	Select first MP3 file in current directory and play it.
CUSTOM_PLAYER_LAST	F4h	Yes	Select last MP3 file in current directory and play it.

Table 3-5 . Player Response (*)

| Protocol Command	Command	Data	Description
SYSTEM_ACK *	80h	1 Byte	General Player acknowledge to Remote Controller's command. Data is the current AT83SND2CMP3 Status byte.
SYSTEM_NACK *	81h	1 Byte	Player non- acknowledge to Remote Controller's command. Data is the current AT83SND2CMP3 Status byte.
FS_NAME *	82h	Yes	Player current file name.
PLAYER_TIME *	83h	3 Bytes	Player current playing time (minute and second since beginning of the file).
PLAYER_INDEXNUMBER *	86h	Yes	Number of files in current directory.
PLAYER_VOLUME *	87h	Yes	Player current analog and digital volume.
FS_FREAD_BLOCK_DATA *	84h	Block	Send data block to Remote Controller's command FS_FREAD_BLOCK.
FS_FREAD_BLOCK_DATA_END *	85h	No	Player response to FS_FREAD_BLOCK command when end of file is reached. Player returns then in IDLE state.
FS_MEMFREESPACE *	8Ah	Block	Free space available on selected memory.
FS_FILESIZE *	8Bh	Yes	Send current file size.

Communication Protocol

Protocol Command	Command	Data	Description
FS_FILEPOS *	8Ch	Yes	Send current file position.
FS_END_OF_LIST *	8Dh	Yes	Player has reached the end of the list after PLAYER_GET_LIST command.
SYSTEM_MOUNTED*	8Fh	No	Player has finished file system FAT instal on selected memory.
CUSTOM_PLAYER_TOTALTIME *	E0h	Yes	MP3 total time length.
CUSTOM_PLAYER_END_OF_FILE *	E1h	Yes	Player has reached the end of file.

Notes: 1. * means that the frame is a Player Response to Remote Controller request.

3.4   Player's Operating Modes

All the commands sent by the Remote Controller can change the Player's current operating mode.

Figure 3-2. Player's Operating Modes
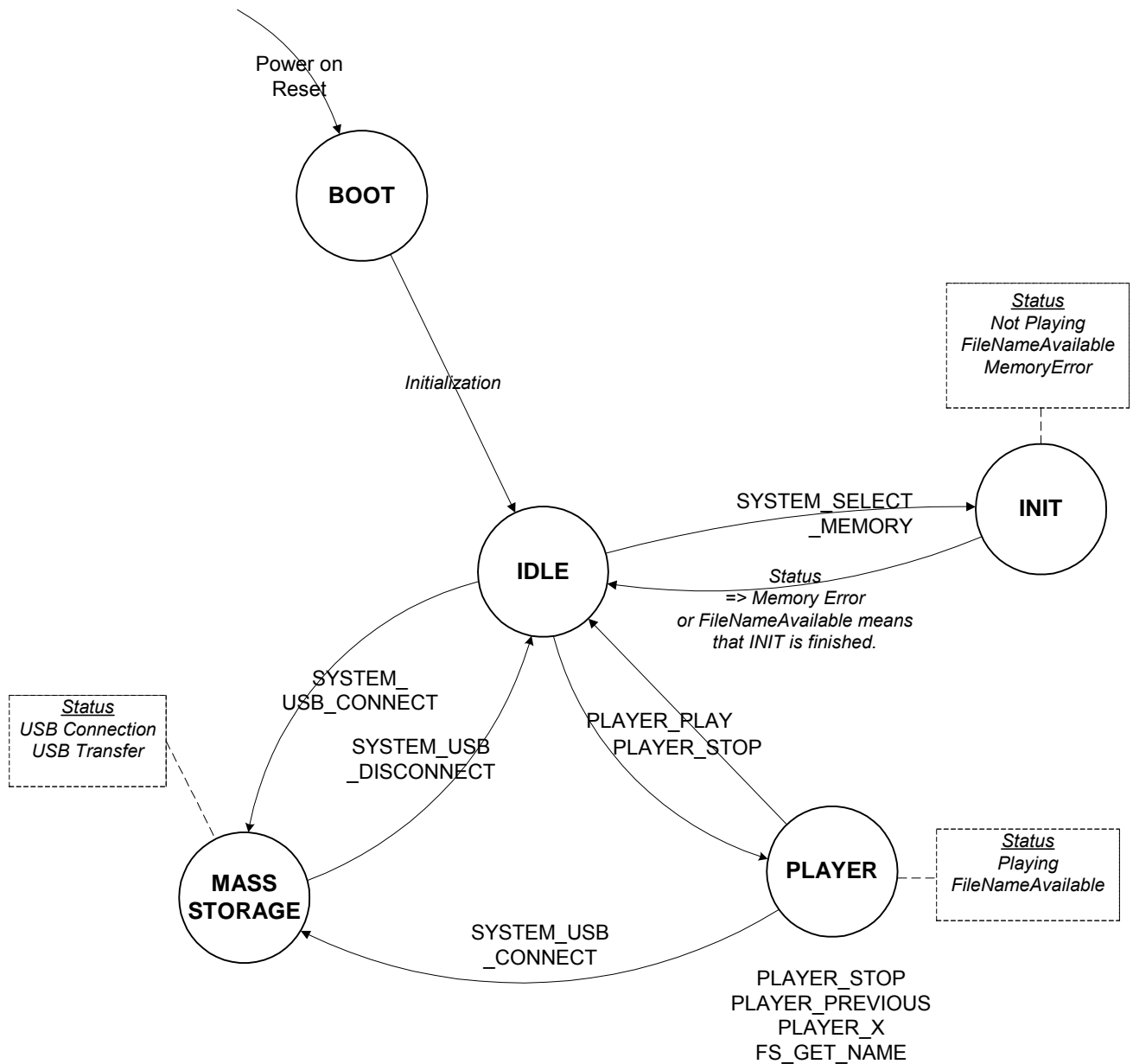
Limitations: During Mass Storage operating mode, if a ring tone occured, it is advised not to play the MP3 and let the user finish the USB mode. Refer to Table 5-12 . SYSTEM_USB_DETACH Command Format

3.5 Error Management

3.5.1 Command Time-out When a communication handling error occurs (for example data length does not correspond to the actual frame size), the AT83SND2CMP3 reception state machine is resetted after `TimeResumeCommand` ms.

If the Remote Controller does not receive any status from Player, it shall wait `TimeResumeCommand` ms before sending the GET_STATUS frame.

Table 3-6 . Real Time Constraints Value

Items	Value	Description
TimeEffectiveCommand	400 ms max.	Maximum Time between Remote Controller command and Player response before time-out, exept for command: SYSTEM_RESET,
TimeResumeCommand	100 ms .	When a communication handling error occurs (for example data length does not correspond to the actual frame size), the AT83SND2CMP3 reception state machine is resetted after `TimeResumeCommand` ms.

3.5.2 Bad CheckSum If Remote Controller sends command with bad checkSum: there is a Player Answer Acknowledge with Command Error. Remote Controller has to retry the command.

3.6 UART Layer

UART Physical layer is:
– RXD signal
– TXD signal

The data byte consists of 10 bits:

■ 1 start-bit

■ 8 data-bit

■ 1 stop-bit

Serial data is transmitted on the TXD pin and received on the RXD pin.

UART default baudrate is 111 111 bps (physical baudrate, correspond to 115200bps - 3.5% error).

Note: To connect Remote Controller and AT89RFD-08 boards, please refer to Hardware User's Guide Boards and check Rx and Tx signals are crossed for each board.

3.6.1 Polling Strategy The protocol implementation does not allow the Player to initiate the communication or to indicate its status update. Therefore, the Remote Controller shall have a polling management using the GET_STATUS command to get the up-to-date Player status. Refer to Table 5-1 . Player STATUS Description.

Here is a the principle of use of the communication protocol with UART layer:
– Remote Controller sends GET_STATUS command to Player,
– Player answers ACK_STATUS to Remote Controller to inform about its status.

Figure 3-3. Protocol communication principle of use
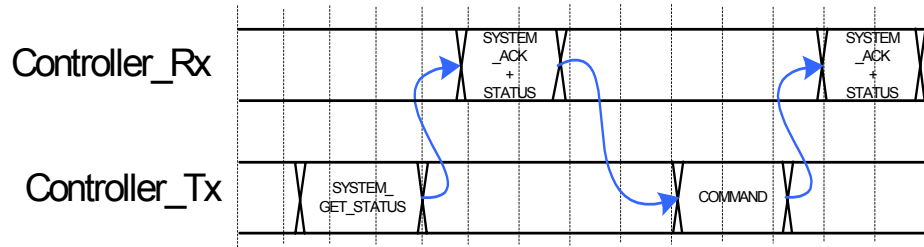
3.7 Player Management

3.7.1 Player Reset

After a Player warm or cold reset, Remote Controller shall wait on its RX line the SYSTEM_ACK frame. This means that the AT83SND2CMP3 is ready to communicate.

Figure 3-4 . Warm Reset
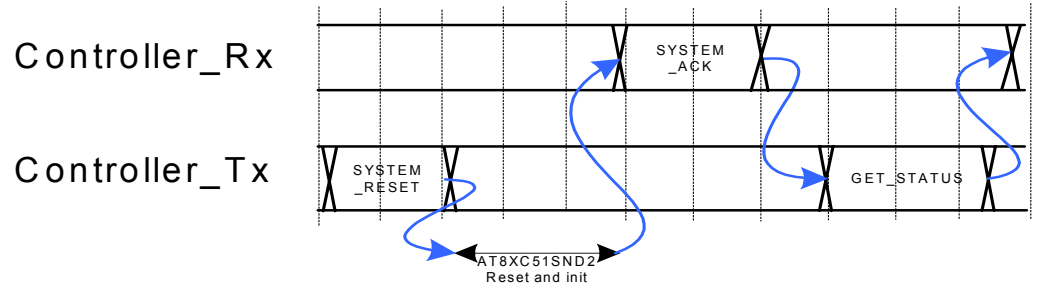
Table 3-7 . Hardware Reset
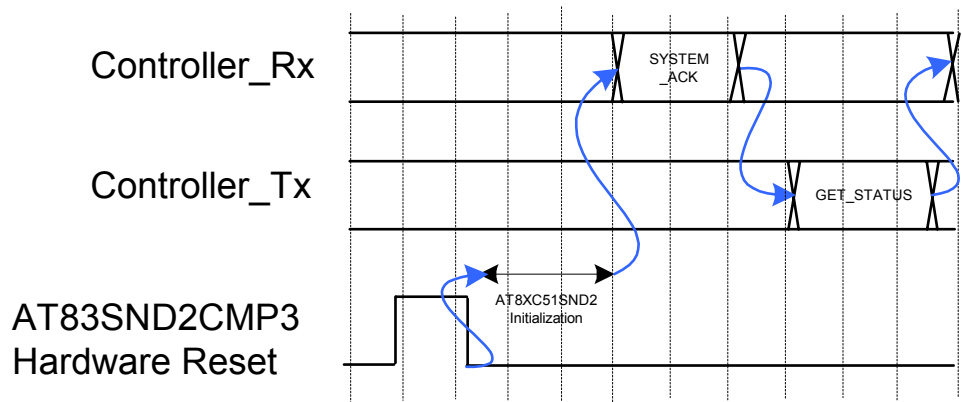
Note: After AT83SND2CMP3 power-up, Remote Controller shall wait to receive the SYSTEM_ACK frame on its RX line.

3.7.2 Player's Status

Player status byte reflects in real time all the events that occur in the AT83SND2CMP3: memory error, playing or not, new file name available, USB events...

Remote Controller should have a polling management with the GET_STATUS command to refresh the Player's status.

The Player's Status Byte contains informations like:

- Playing or idle
- Memory Error
- USB Connection
- USB File Transfer
- New File Name available
- CheckSum Error

The SYSTEM_ACK_STATUS frame response is the acknowledge for the received frame and the corresponding command processed.

Note: Refer to Table 5-1 . Player STATUS Description

Example 1   **Table 3-8 .** Example: select memory and get name of current file
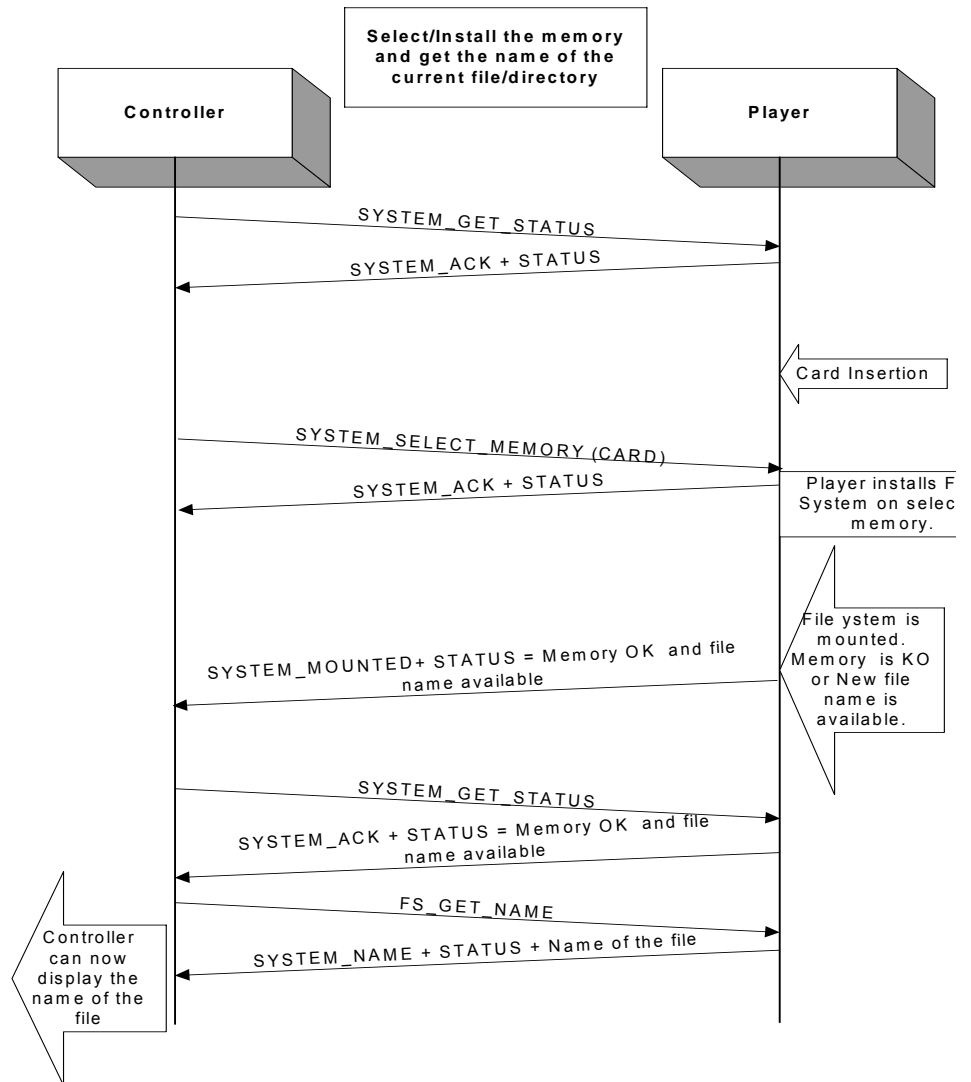
Example 2   **Figure 3-5 .** Example: Play a MP3 file
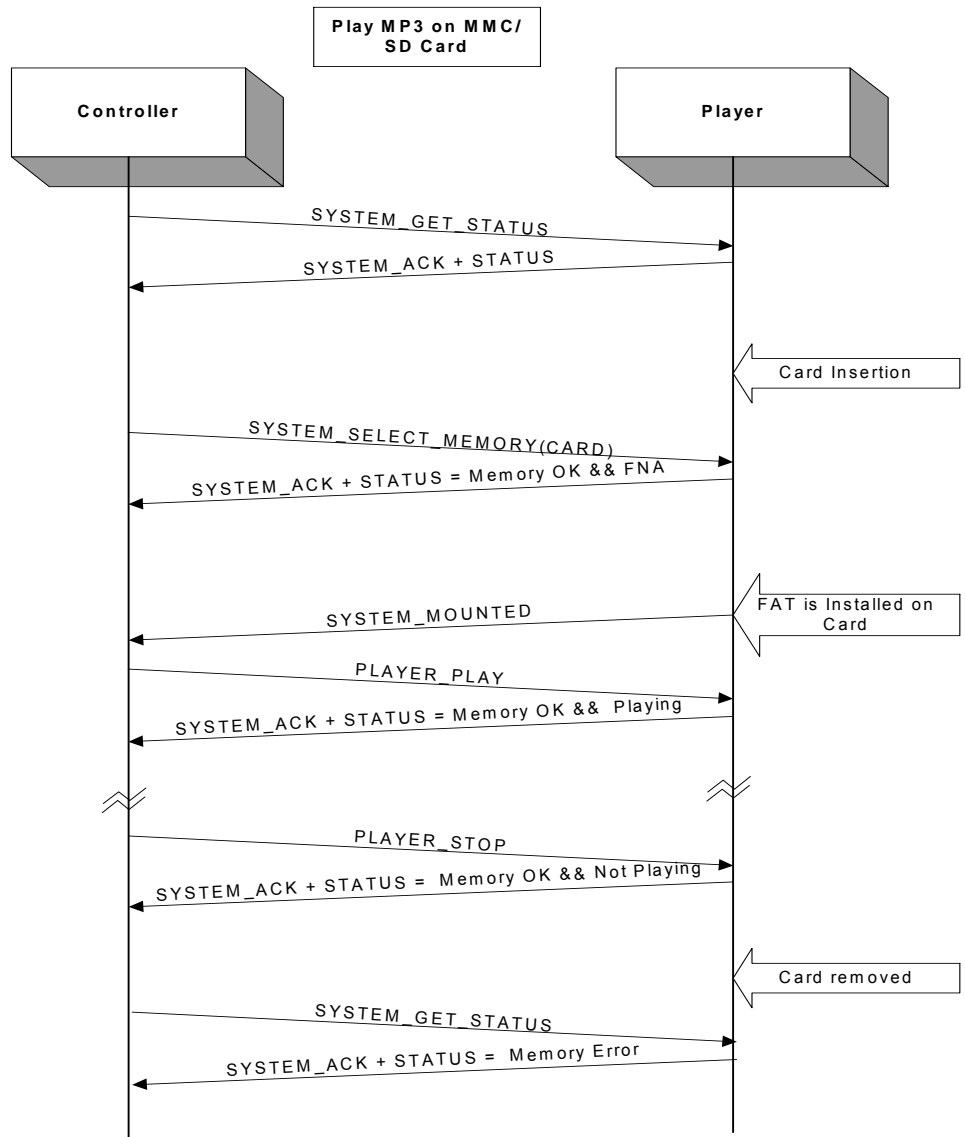
3.8   File Transfer

The File Transfer mode is used to transfer file from/to Remote Controller to/from Player Memory.
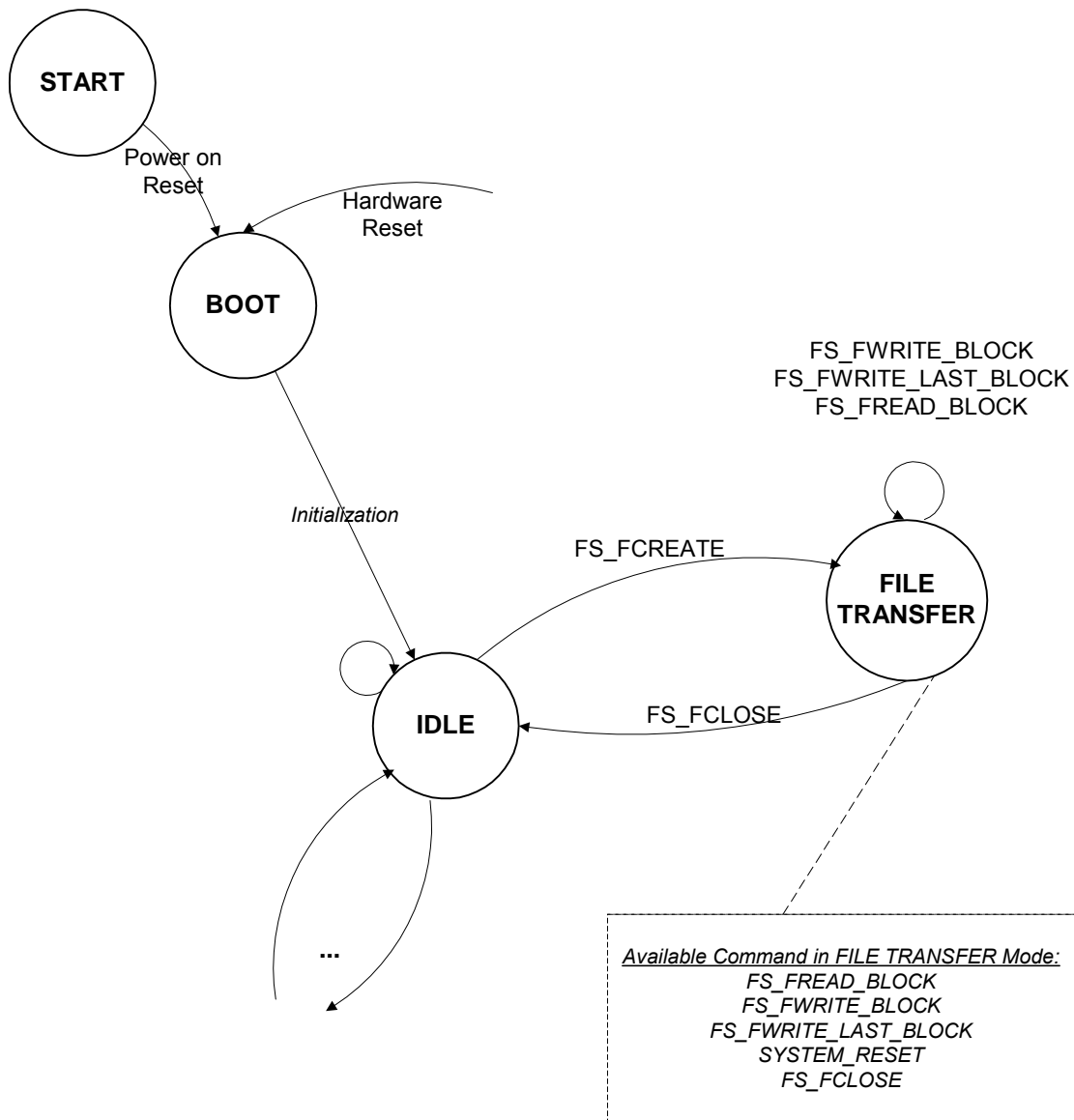
3.8.1   Protocol Communication Use

The following commands:

– FS_FCREATE
– FS_FWRITE_BLOCK
– FS_WRITE_LAST_BLOCK
– FS_FREAD_BLOCK
– FS_FCLOSE
– FS_READ_BLOCK_DATA *
– FS_READ_BLOCK_DATA_END *

are the basic file transfer interface functions for the Remote Controller.

Note: * means that the frame is a Player Response to Remote Controller request.

Example 1 **Figure 3-6 .** Transfer a File From Remote Controller to Player Selected Memory
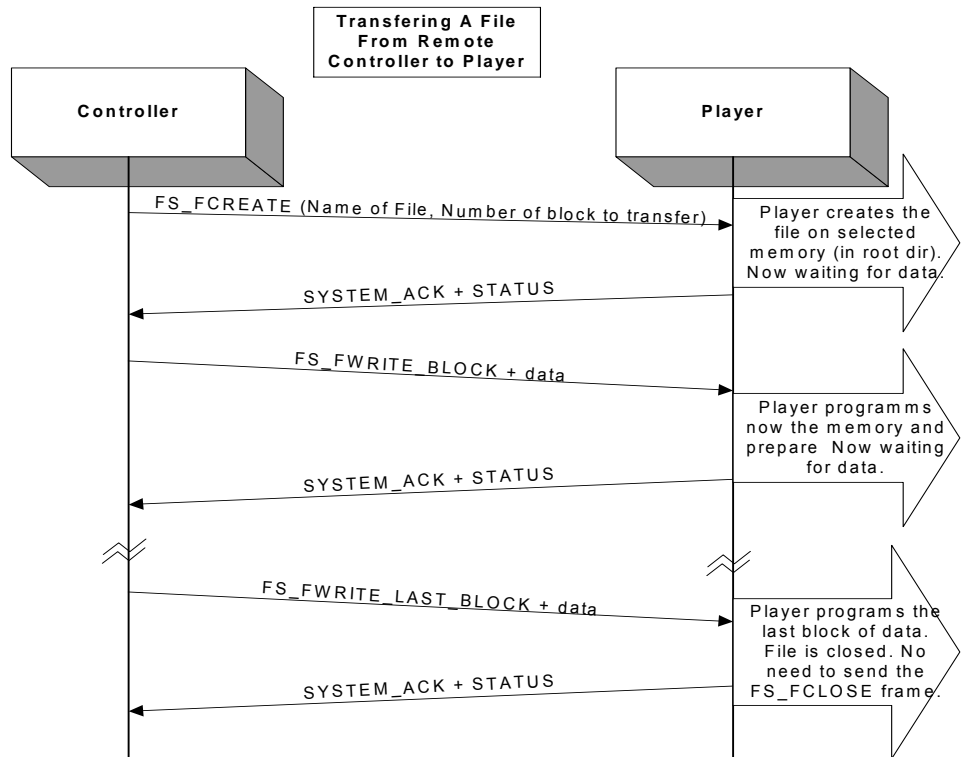
During the file write transfer, after the FS_FCREATE command, no other commands than FS_FWRITE_BLOCK, FS_FWRITE_LAST_BLOCKor FS_FCLOSE are allowed to finish the file transfer because the AT83SND2CMP3 is an optimized transfer mode.

To create the file "wr_test.mp3" (total size 1312 Bytes: 2 block of 512 bytes + last block 288 bytes):

■ Send FS_FCREATE (3 blocks, 'w' 'r' '_' 't' 'e' 's' 't' '.' 'm' 'p' '3' '\0')

■ Wait for response SYSTEM_ACK* frame.

■ Send FS_FWRITE_BLOCK + 1st block of data (512 bytes),

■ Wait for response SYSTEM_ACK* frame.

■ Send FS_FWRITE_BLOCK + 2nd block of data (512 bytes)

■ Wait for response SYSTEM_ACK* frame.

■ send FS_FWRITE_LASTBLOCK (288 bytes) + last block of data (288 bytes)

■ Wait for response SYSTEM_ACK* frame. The file is now created.

Note: If Player response is SYSTEM_NACK to any command during this procedure, the Player
         will return into the IDLE state and the file creation procedure will be aborted.

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Example 2 **Figure 3-7 .** Example: Transfer a File From Player to Remote Controller
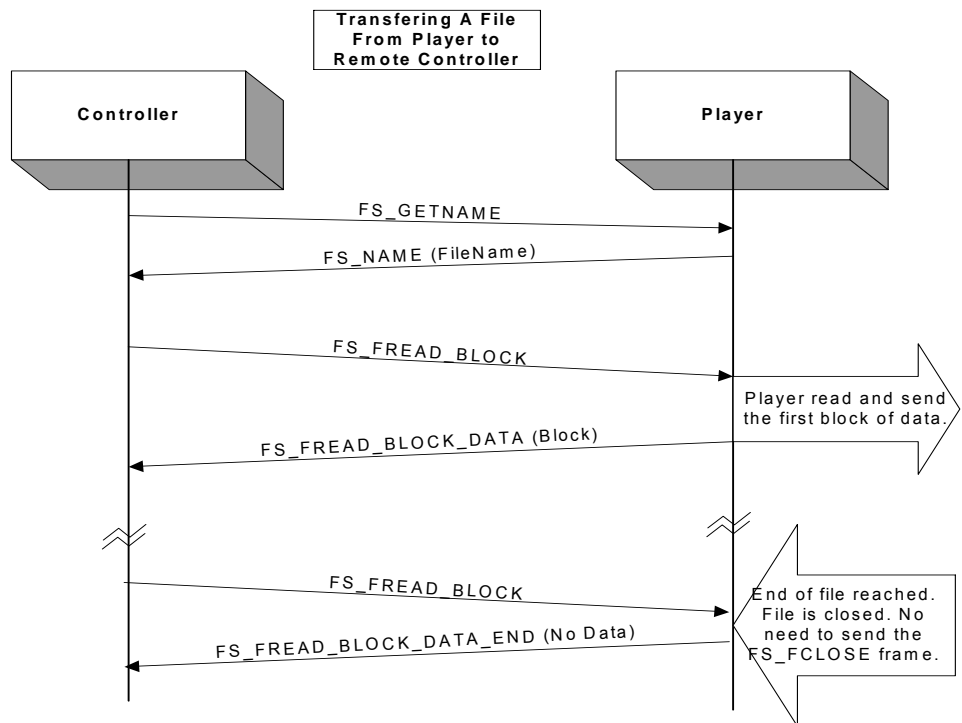
The FS_READ_BLOCK read the file until the end of the sector size in memory. To know the total file size, the Remote Controller shall send the FS_GETFILE_SIZE command.

Section 4

Design

4.1 Configuration

4.1.1 Connections

Refer to AT83SND2CMP3 schematics.

Table 4-1 . Remote Controller - AT83SND2CMP3 Interface
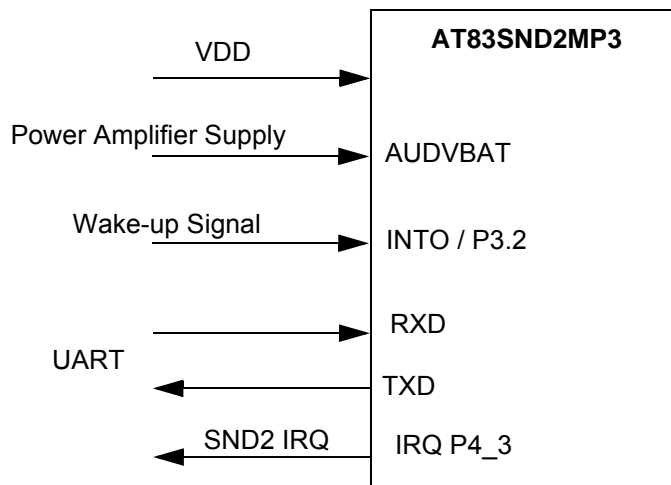
Note: SND2 IRQ and INTO shall stay not connected if they are not used.

4.1.2 USB IDs

Three IDs are available for configuration by the user :

- Vendor ID
- Product ID
- Release Number ID

According to USB Organization: "Vendor ID (VID) is owned by the vendor company and is assigned and maintained by the USB-IF only. E-mail admin@usb.org for more information on USB-IF membership and obtaining a VID".

Atmel allows limited usage of its VID (03EBh) during product development phase. Customer use of the Atmel Vendor ID is not guaranteed by Atmel. The customer must use its own Vendor ID for production.

Note: Refer to SYSTEM_CONFIG command.

The following strings are printed during USB drivers installation and during disk drivers

status report in host system:

- USB_MANUFACTURER_NAME: unicode character string (default "ATMEL")
- USB_PRODUCT_NAME: unicode characters string("MP3 STORAGE")
- USB_SERIAL_NUMBER: unicode characters string ("4710765066451")
- SBC_VENDOR_ID: 8 ASCII characters string (default "03EBh", ATMEL VID)
- SBC_PRODUCT_ID:16 ASCII characters string (default "2010h", ATMEL PID)
- SBC_REVISION_ID: 4 ASCII characters string ("1.00")

Default number of USB logical unit s one (= number of drive seen by Windows explorer). It is necessary to select one memory (NandFlash or MMC/SD card) before entering mass storage mode.

To have 2 logical unit (= number of drive seen by Windows explorer), please refer to command SYSTEM_CONFIG.

| 4.1.3 | **File system** | AT83SND2CMP3 supports file system FAT12/16 and FAT32. |

4.1.4   AT83SND2CMP3 IRQ IO

The SND2_IRQ IO P4_3 is used as an output for interrupt request from AT83SND2CMP3 to Controller. This IO is cleared when Player status is updated by:

- initialization finished (after Reset),
- USB connection/detach,
- end of MP3 file reached when playing,
- Memory format is OK.
- FAT install finished and OK.

This IO is set when status is read by any command by the Remote Controller (SYSTEM_GET_STATUS command for example).

4.1.5   Audio Gain

The Audio gain default value are:

- MP3 VOLUME LEFT: MP3 digital volume left channel (default value : settings Medium: 0Fh)
- MP3 VOLUME RIGHT: MP3 digital volume right channel (default value : settings medium: 0Fh)
- MP3 BASS (default value : settings medium: 0Fh)
- MP3 MEDIUM (default value : settings medium: 0Fh)
- MP3 TREBBLE (default value : settings medium: 0Fh)
- Line out (default value i: 02h, -3 dB).
- Power Amplifier (default value : 07h, +2 dB).
- Line in (default value : 08h, -9 dB).
- Auxiliary in (default value: 07h, -6 dB).
- Dac Master Gain (default value : 0Ch, -6 dB).

All these values can be updated with commands from Remote Controller.

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4.2 Mass Storage Driver

The ZIP file "usb_ms_drv" contains the Windows 98™ driver for the USB mass storage application. The `readme` files gives advice on how to install drivers on windows 98™ platform and how to mount the removable disk on Linux™ platform.

Figure 4-1 . `usb_ms_drv` Directory Organization

```
usb_ms_drv \ atusbms.zip
           \ readme.txt
           \ readme_linux.pdf
```

4.2.1 Windows Drivers
No specific mass storage driver installation is requested when using Windows 2000™, Windows ME™, and Windows XP™. Each system loads the generic mass storage driver when plugging the development board to the PC.
As no generic driver is available under Windows 98SE™ system, Atmel has developed its own mass storage driver to support this operating system. This driver is based on 3 files: `atusbms.sys`, `atusbpdr.pdr` and `atusbms.inf`.
Install information is provided in `readme.txt` file under `usb_ms_drv` directory.

4.2.2 Linux Drivers
Install information for linux is provided in `readme_linux.pdf` file under `usb_ms_drv` directory.

Section 5

Protocol Frame Description

Note: (*) means the frame is a Player response.

5.1 Player's Status Description

STATUS byte is the reflect in real-time of AT83SND2CMP3's system status. This status is a parameter of almost all Player frame.

Table 5-1 . Player STATUS Description

7	6	5	4	3	2	1	0
OPM	ERROR	MERROR	MNF	USB_CON	USB_TRANS	-	FNA

Bit Number	Bit Mnemonic	Description
7	**OPM**	**Operating Mode** This is bit is set when playing music. This bit is cleared when Player is in idle mode (not playing)
6	**ERROR**	**Command Error** This bit is set when a checksum error occurs with the last Remote Controller command. This bit is cleared when there is no error with the last frame.
5	**MERROR**	**Memory Error** This bit is set when selected memory is KO This bit is cleared when selected memory is OK.
4	**MNF**	**Memory Not Formated** This bit is set when selected memory is not formated. This bit is cleared when selected memory is OK.
3	**USB_CON**	**USB Connection** This bit is set when an USB connection occured. This bit is cleared when there is no USB connection.

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Bit Number	Bit Mnemonic	Description
2	USB_TRANS	**USB Transfer** This bit is set when an USB data transfer is being processed. This bit is cleared when there is no USB transfer.
1	Reserved	**Reserved.**
0	FNA	**File name available.** This bit is set when new file name is available. This bit is cleared when Remote Controller has read the new file name. This bit is set when new FAT is installed on memory after a SYSTEM_SELECT_MEMORY command.

STATUS byte is in byte 0 of data field of SYSTEM_ACK frame Player's response.

In case of Status ERROR, the Remote Controller should re-send the command again else retry its command after Time-out.

5.2   System Command

SYSTEM_RESET Command   Reset the AT83SND2CMP3. There is no answer for this command.

After a Player warm or cold reset, Remote Controller shall wait on its RX line the followings response SYSTEM_ACK frame. This means that the AT83SND2CMP3 is ready to communicate.

Table 5-2 . SYSTEM_RESET Frame Format

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	00h	00h	No	Yes

Note: As Audio analog capacitors (Headset and Power Amplifier) need to be discharged before Player Reset, the reset can occurs after 1 or 2s.

SYSTEM_CONFIG Command   The SYSTEM_CONFIG command configure the player information like:

- USB number of logical unit (mass storage)
- USB VID update
- USB PID update

Default number of USB logical unit in is 1.

Table 5-3 . SYSTEM_CONFIG Frame Format

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	01h	05h	Yes	Yes

SYSTEM_CONFIG Parameters	Description
Byte 0	**USB Number of logical unit** - for Nand flash only: 01h - for MMC/SD card only: 02h - for Nandflash and MMC/SD card: 03h
Byte 1:2	**USB Vendor ID** Atmel VID is 03EBh (default value) Byte 1: MSB(VID) Byte 2: LSB(VID)
Byte 2:3	**USB Product ID** Atmel PID is 2010h (default value) Byte 2: MSB(PID) Byte 3: LSB(PID)

SYSTEM_GET_STATUS Command   The SYSTEM_GET_STATUS frame can be send at any time to ask AT83SND2CMP3 status.

AT83SND2CMP3 frame response is SYSTEM_ACK frame.

Table 5-4 . SYSTEM_GET_STATUS Frame Format

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	02h	00h	No	Yes

SYSTEM_AUDIO_OUTPUT Command — Select Player Audio Output:

- Headset
- Power Amplifier

The default configuration is Headset and Power Amplifier activated after reset.

Table 5-5 . SYSTEM_AUDIO_OUTPUT Frame Format

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	03h	01h	AUDIO_OUTPUT (1 byte)	Yes

Table 5-6 . AUDIO_OUTPUT Format

Audio Output	AUDIO_OUTPUT Parameter Value (1 byte)
None	00h
Headset	01h
Reserved	02h
Headset and Power Amplifier	03h

Note: The Audio output "None" will power off the Audio Headset capacitors (from VDD/2 to 0V). The Audio output None shall be used only before a hardware reset to avoid any 'plop' on audio headset.

SYSTEM_SELECT_MEMORY Command — Select Memory and mount file system FAT on memory. Player response is SYSTEM_ACK frame.

When FAT is installed on selected memory, player's status byte is updated with:

- FNA set (File name available, Table 5-1 . Player STATUS Description). This flag is set when FAT install is OK. Then Player is ready to process the 'PLAY' command.
- MERROR set (Memory Error, Table 5-1 . Player STATUS Description). This flag is set when memory initialization is KO or card is not present (for memory card slot).
- MNF is set (Memory not formated, Table 5-1 . Player STATUS Description). This flag is set when selected memory is not formated.

Table 5-7 . SYSTEM_GET_STATUS Frame Format

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	04h	01h	Select Memory and install file system on: • On-Board Player Memory (Nand Flash) • Card (SD/ MMC card)	Yes

Table 5-8 . Data Parameter for Select Memory Command.

Memory to Select	Data Parameter Value (1 byte)
Memory Card (SD / MMC)	01h
On Board Player Memory: Nand Flash	02h
Reserved	82h
Reserved	03h

SYSTEM_SET_SOUND Command System Set Sound Command is used to configure AT83SND2CMP3 Sound system after a POWERDOWN Command or a general system RESET.

Player response is PLAYER_VOLUME* frame.

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	05h	05h	Byte 0: MP3 DIGITAL VOLUME LEFT Byte 1: MP3 DIGITAL VOLUME RIGHT Byte 2: MP3 BASS Byte 3: MP3 MEDIUM Byte 4: MP3 TREBBLE	Yes

Data are 5 bytes of Volume settings

- – MP3 VOLUME LEFT: MP3 digital volume left channel
- – MP3 VOLUME RIGHT: MP3 digital volume right channel
- – MP3 BASS
- – MP3 MEDIUM
- – MP3 TREBBLE

Each of these 5 bytes must be in the following:

- • Settings Minimum: 00h
- • Settings Medium: 0Fh
- • Settings Maximum: 1Fh

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Table 5-9 . System Set Sound Data Command

Byte Number	Byte Mnemonic	Description
0	MP3VOL	MP3 Volume Left Channel
1	MP3VOR	MP3 Volume Right Channel
2	MP3BASS	MP3 Bass equalization
3	MP3MED	MP3 Medium equalization
4	MP3TRE	MP3 Treble equalization

Note: All value set to FFh will not be updated in Player. Example: MP3VOL set to FFh means tMP3VOL will keep its last value.

SYSTEM_POWER_DOWN Command   SYSTEM_POWER_DOWN command enables the Remote Controller to power down AT83SND2CMP3 system. The Audio capacitors are discharged before entering the power down mode. The AT83SND2CMP3 is placed then in a very low power state. To wake it up, refer to SYSTEM_WAKEUP command.

Table 5-10 . SYSTEM_POWER_DOWN Command Format

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	06h	00h	No	Yes

Note: To avoid audio capacitors discharge in power down mode, refer to command CUSTOM_SYSTEM_SLEEP (power down with audio capacitors charged).

SYSTEM_WAKEUP Command   SYSTEM_WAKEUP Command is a special command: it is 1ms (at least) of logical level "0" on AT83SND2CMP3 GPIO INT0.

In the case that Remote Controller Tx is connected to AT83SND2CMP3 INTO, it is possible to change the Remote Controller UART baudrate to 9600bps and send the byte 00h.

AT83SND2CMP3 UART is not active in Power down mode.

Note: INTO (P3.2) pin is an external interrupt that enable the AT8xC51SND2C to wake up if a low level is applied on it.

Figure 5-1 . AT83SND2CMP3 Configuration for SYSTEM_WAKEUP Command
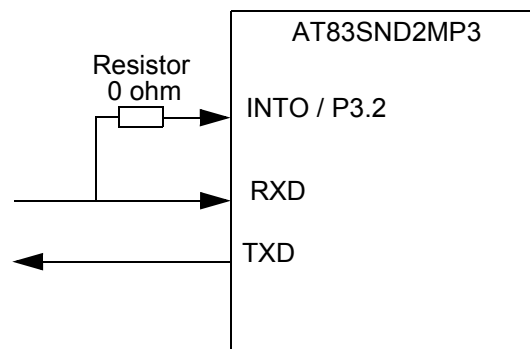
Table 5-11 . SYSTEM_WAKEUP command
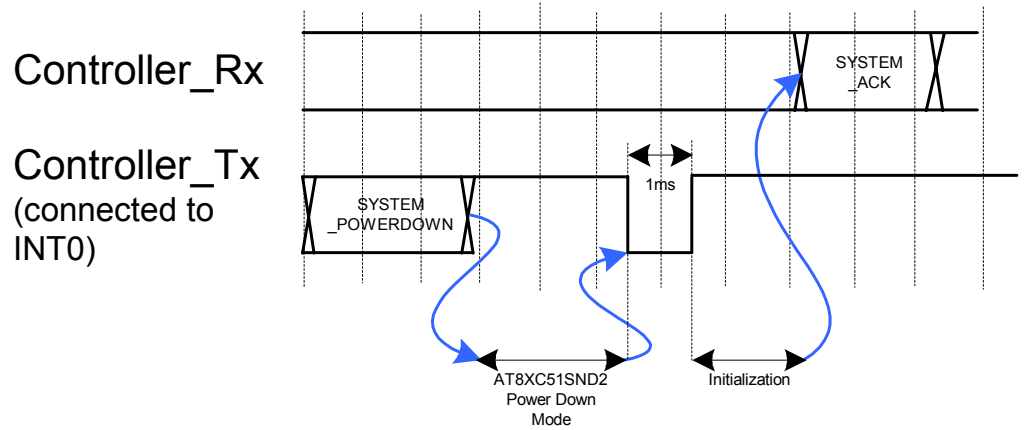
SYSTEM_USB_DETACH Command Request the Player to perform a USB detach.

Warning: during USB data transfer, performing a USB detach can corrupted the current data transfered on the memory.

In USB mode, the Remote Controller must check the USB_CONNECTED status bit in AT83SND2CMP3 Status byte to be informed of a manual USB detach.

Table 5-12 . SYSTEM_USB_DETACH Command Format

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	08h	00h	No	Yes

SYSTEM_USB_CONNECT Command SYSTEM_USB_CONNECT is a Remote Controller command to Player for asking an USB Connection.

Table 5-13 . SYSTEM_USB_CONNECT Command Format

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	09h	00h	No	Yes

SYSTEM_VOLUME_UP Master gain volume up (one step). Player response is PLAYER_VOLUME* frame.

Table 5-14 . SYSTEM_VOLUME_UP command format

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	0Bh	00h	No	Yes

SYSTEM_VOLUME_DOWN Master gain volume down (one step). Player response is PLAYER_VOLUME* frame.

Table 5-15 . SYSTEM_VOLUME_DOWN command format

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	0Ch	00h	No	Yes

SYSTEM_PLAYER_MODE Set player mode for the selected memory:

- Repeat / No Repeat the Play mode
- Play modes:
  - Play single file
  - Play Dir
  - Play Disk

Table 5-16 . Player Mode

7	6	5	4	3	2	1	0
REPEAT	-	-	FILETYP2	FILETYP1	FILETYP0	MOD1	MOD0

Bit Number	Bit Mnemonic	Description
7	REPEAT	**Repeat Mode** Clear for no repeat mode. Set for repeat mode.
6:5	-	**Reserved**
4:2	FILETYP	**Player File type** Set to 000b to see MP3 files only, set to 100b to see all files extensions on selected memory (file transfer mode).
1:0	MOD	**Play mode.** Refer to Table 5-17 . Play Mode (MOD 1:0).

Table 5-17 . Play Mode (MOD 1:0)

Player Mode (PLAYER_MODE)	MOD1	MOD0
Play Single File	0	0
Play Dir	0	1
Play Disk	1	0

Table 5-18 . Player File Type (FILETYP 4:2)

Player File Type (FILETYPE)	FILETYP2	FILETYP1	FILETYP0
Mp3 Files only.**	0	0	0
All files extensions are visible. (Explorer mode for file transfer)	1	0	0

Table 5-19 . SYSTEM_PLAYER_MODE command format

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	0Dh	01h	Byte 0: PLAYER _MODE	Yes

SYSTEM_AUDIO_INPUT Select Player Audio Input Channel:

- None
- Mono Input (AUXN, AUXP)
- Stereo Input (LINEL,LINER)

The Select Input 'None' is a Mono/ Stereo output disable function. When Input channel have to be closed, Remote Controller shall send the Select Input 'None'.

After a PowerDown mode, the Remote Controller shall re-configure the audio input as wanted.

Table 5-20 . SYSTEM_AUDIO_OUTPUT Command Format

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	0Eh	01h	AUDIO_INTPUT (1 byte)	Yes

Table 5-21 . AUDIO_INPUT Format

Audio Input Selected	AUDIO_INPUT Parameter Value (1 byte)
None	00h
Mono	01h
Stereo	02h

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SYSTEM_ENTER_HID_MODE   Ask the Player to enter the HID mode (only available with UART link). The Player shall be in IDLE state to enter HID mode (no Mass Storage, no Playing).

When connected in this way, the Player acts only as USB-UART bridge. This mode allow the Remote Controller to send and receive any binary/protocol information from/to UART.

To exit from this mode, Remote Controller have to perform an hardware Player Reset or unplug the USB cable.

Table 5-22 . SYSTEM_ENTER_HID_MODE Command Format

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	Not used, FFh	0Fh	00h	No	Yes

Figure 5-2 . Player USB-UART Bridge
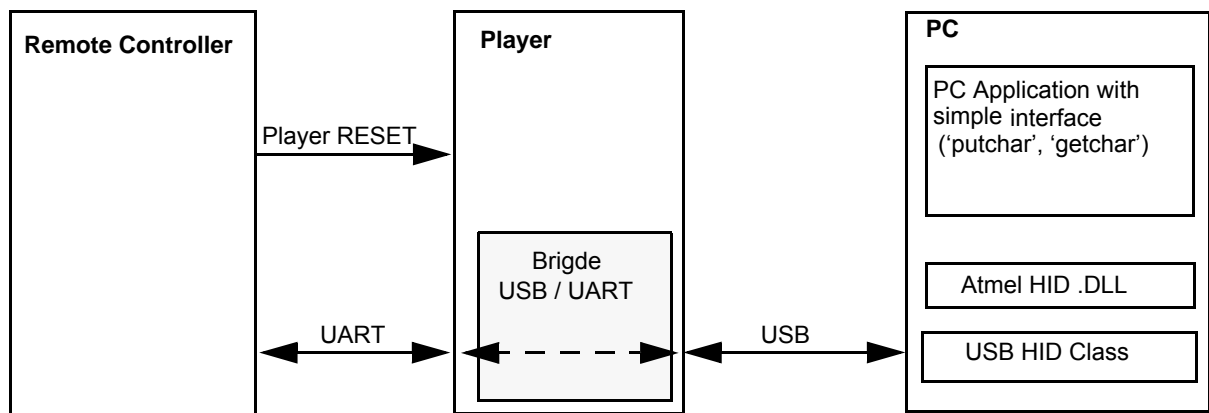
5.3   Player Command

These commands allow to access all the player's function.

PLAYER_PLAY Command   If current file name is a MP3 file, play selected MP3 file from Selected Memory. If current file name is a directory, enter this directory and select the first MP3. A new Play command is needed to play this new MP3 file.

Table 5-23 . PLAYER_PLAY command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	50h	00h	No	Yes

PLAYER_STOP Command   Stop playing current MP3 file.

Table 5-24 . PLAYER_STOP command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	51h	00h	No	Yes

PLAYER_PAUSE Command   Pause playing current MP3 file.

Table 5-25 . PLAYER_PAUSE command :

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	52h	00h	No	Yes

PLAYER_NEXT Command   Select Next MP3 file on selected memory.

Table 5-26 . PLAYER_NEXT command :

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	53h	00h	No	Yes

PLAYER_PREVIOUS Command Select Previous MP3 file on Selected Memory.

Table 5-27 . PLAYER_PREVIOUS command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	54h	00h	No	Yes

PLAYER_SETMARKERA Command Set A marker for repeat AB feature.

Table 5-28 . PLAYER_SETMARKERA Command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	55h	00h	No	Yes

PLAYER_SETMARKERB Command Set B marker for repeat AB feature.

Table 5-29 . PLAYER_SETMARKERB Command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	56h	00h	No	Yes

PLAYER_STOPAB Command Stop AB repeat mode.

Table 5-30 . PLAYER_STOPAB Command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	57h	00h	No	Yes

PLAYER_GET_TIME Command Get Player playing time since the beginning of the file .

Table 5-31 . PLAYER_GET_TIME Command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	58h	00h	No	Yes

Player response is PLAYER_TIME* frame.

PLAYER_GETINDEXNUMBER Command

Get numbers of files in current directory or root directory.

Table 5-32 . PLAYER_GETINDEXNUMBER Command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	59h	00h	No	Yes

Player response is PLAYER_INDEXNUMBER* frame.

PLAYER_ENTER_ROOT_DIR Command

Select first available MP3 files in the root directory. Player response is SYSTEM_ACK or SYSTEM_NACK frame (no MP3 file found or low level error).

Table 5-33 . PLAYER_ENTER_ROOT_DIR Command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	5Ah	00h	No	Yes

PLAYER_SET_FILTER Command

Set file filters (no directory, only MP3 files are seen). This command has be sent before the SYSTEM_SELECT_MEMORY command because the filter are used during file system FAT install.

Table 5-34 . PLAYER_SET_FILTER Command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	5Bh	01h	Byte 0: Filter - 00h No filter - 01h Filter directory (no directory seen only MP3 files)	Yes

PLAYER_GET_FILE_LIST Command

Get file name list in current directory or root directory.

Table 5-35 . PLAYER_GET_FILE_LIST Command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	5Ch	00h	No	Yes

Player reponse is:

■ FS_NAME* frame for each file name in current directory

■ FS_END_OF_LIST* frame when end of list is reached. First file of the list is then selected and become current file.

Example:

– Remote Controller sends PLAYER_FILE_GET_LIST command
– Player sends 3 FS_NAME* frame because there is 3 files in current directory.
– When all the files names are send, Player sends FS_END_OF_LIST* frame.

The sequence can be aborted by any other command send to the Player (for example SYSTEM_GET_STATUS command). After get list aborted, it is necessary to re-send the new comma

5.4 File System Commands

These commands allow to navigate in selected memory: file and directory architecture.

FS_NEXT Command Select next file from selected memory.

Table 5-37 . FS_NEXT command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	60h	00h	No	Yes

FS_PREVIOUS Command Select previous file from selected memory.

Table 5-38 . FS_PREVIOUS command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	61h	00h	No	Yes

FS_ENTER_DIR Command File System Enter Directory on selected memory and select the first found file / directory.

Table 5-39 . FS_ENTER_DIR command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	62h	00h	No	Yes

FS_EXIT_DIR Command File System Exit Directory on Selected Memory.

Table 5-40 . FS_EXIT_DIR command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	63h	00h	No	Yes

FS_GET_NAME Command File System Get Name of Current File or Directory on Selected Memory. The Player response is a SYSTEM_NAME that contains the name of the current file (unicode).

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Table 5-41 . FS_GET_NAME command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	64h	00h	No	Yes

Note: When selected root or directory is empty, the returned file name is '\0'.

FS_FORMAT Command Format Selected Memory in FAT16. Player reponse is SYSTEM_ACK* or SYSTEM_NACK* frame.

It is necessary to send the SYSTEM_ SELECT_MEMORY once (to select the memory) before sending the FS_FORMAT command.

Player status can be viewed in Status Byte (Memory Error or File Name Available).

Table 5-42 . FS_FORMAT command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	65h	00h	No	Yes

Note: Depending of the memory type and size, Player response can be up to several seconds. NandFlash 64 Mo: ~6 seconds, SD card: ~4 seconds.

FS_FCREATE Command Create a File in root dir in Selected Memory. Once this file is created, Player is waiting for *'Number of Blocks'* FS_FWRITE_BLOCK commands.

Table 5-43 . FS_FCREATE command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	66h	Nh	Byte 0 MSB(Number of blocks) Byte 1 LSB(Number of blocks) Byte 2:N-1 File Name (must finish with '\0').	Yes

■ *Block size*: Depending of transfer link, size of a block can change. For the UART link, block size is always equal to sector size 512 bytes. Block size is not a parameter in FS_FCREATE command.

■ *Number of Blocks* Parameter: this is File length in Block. For a 2384 Bytes File, it is necessary to transfer 5* FS_WRITE_BLOCK commands (Number of Blocks = 5) with stuffing bytes in last command FS_WRITE_BLOCK.

■ The *File_Name* is a ASCII long filename with extension already formatted: "*song1.mp3*". Example: File_name 'S','O','N','G','1' , '.' , 'M', 'P', '3' '\0'. File name length is limited to 8 characters. Extension is limited to 3 characters.

To create a File:
– FS_CREATE (Number of blocks, File name),
– (Number of blocks-1) x FS_WRITE_BLOCK (512 bytes data),
– FS_WRITE_LAST_BLOCK (Number of bytes < 512), Player response is then SYSTEM_ACK. File is created.

FS_FWRITE_BLOCK Command Write data in current created file (need previous FS_FCREATE command). The number of FS_WRITE_BLOCK command the Remote Controller shall send to Player is defined by *Number of Blocks* Parameter (refer to FS_FCREATE command).

Table 5-44 . FS_FWRITE_BLOCK command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum	Data BLock
7Eh	If not used, FFh	68h	00h	-	Yes	Byte 0:1FFh => 512 Bytes data (no checksum on data)

Data are 512 Bytes. Checksum is only for command, not for data (specific to FS_FWRITE_BLOCK).

The command FS_FWRITE_LAST_BLOCK is used for the last block transfer.

FS_FWRITE_LAST_BLOCK Command Write data in current created file (need previous FS_FCREATE command). This command is used for the last block transfered.

Parameters of FS_FWRITE_BLOCK is the number of byte to finish the file write.

Table 5-45 . FS_FWRITE_BLOCK command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum	Data BLock
7Eh	If not used, FFh	6Dh	02h	Byte 0: MSB (Number of Bytes to write) Byte 1: LSB (Number of Bytes to write)	Yes	Byte 0:Xh => X-1 Bytes data (no checksum on data)

The command FS_FWRITE_LAST_BLOCK is used for the last block transfer.

After the latest FS_FWRITE_LAST_BLOCK command, it is not necessary to send FS_FCLOSE command as Player will return in IDLE state.

Player response is SYSTEM_ACK*. File is created.

FS_FREAD_BLOCK Command This Command allows Remote Controller to read current selected file in memory.

Table 5-46 . FS_FREAD_BLOCK command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	67h	00h	No	Yes

With UART link, data length parameter is equal to 1 block. Data block size is 512 Bytes, coming after the Player response frame: FS_FREAD_BLOCK_DATA*. Checksum is only for command, not for data.

Player response to FS_FREAD_BLOCK command is FS_READ_BLOCK_DATA*.

Once end of file is reached, Player response to FS_READ_BLOCK command is FS_READ_BLOCK_DATA_END*. Remote Controller can stop reading file at any moment by sending the FS_FCLOSE command.

Note: (*) means that the frame is a player response.

FS_FCLOSE Command Close current file (close read or close write file). This command is used to stop any read or write file transfer. This command is **not** necessary :

■ when reading file and end of file is reached (FS_READ_BLOCK_DATA_END* response).

■ when writing the last block of the file.

Table 5-47 . FS_FCLOSE command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	69h	00h	No	Yes

FS_GETMEMFREESPACE Get selected memory free space left.

Table 5-48 . FS_GETMEMFREESPACE command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	6Ah	00h	No	Yes

Player response is FS_MEMFREESPACE* frame.

FS_GETFILESIZE Get current file size in Byte.

Table 5-49 . FS_GETFILESIZE command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	6Bh	00h	No	Yes

Player response is FS_FILESIZE* frame.

Note: Directory size is 0.

FS_GETFILEPOS Get current file position (playing operating mode only).

Table 5-50 . FS_GETFILEPOS command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	6Ch	00h	No	Yes

Player response is FS_FILEPOS frame.

FS_FDELETE   Delete the current selected file.

Table 5-51 . FS_FDELETE command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	6Dh	00h	No	Yes

Player response is SYSTEM_ACK or SYSTEM_NACK frame.

5.5   Custom Command

AUDIO_SET_GAIN   Set Audio Gain:

- Line out (default value: 02h, -3 dB).
- Power Amplifier (default value: 07h, +2 dB).
- Line in (default value: 08h, -9 dB).
- Auxiliary in (default value: 07h, -6 dB).
- Dac Master Gain (default value: 0Ch, -6 dB).

Refer to AT83SND2CMP3 datasheet (chapter DAC and PA Interface) for audio gain description and register value.

Table 5-52 . AUDIO_SET_GAIN command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	91h	02h	Byte 0: Gain Selector Byte 1: Gain Value	Yes

Table 5-53 . AUDIO_SET_GAIN parameter

Gain Selector	Gain Value	Corresponding Register in datasheet
Line Out Gain 00h	00000000b => 0 dB ... 00000010b => -3 dB ... 00100000b => mute	LLOG, RLOG
Power Amplifier Gain 01h	00000000b => -22 dB 00000001b => + 20 dB ... 00001000b => -1 dB 00001011b => -10 dB ... 00001111b => -22 dB	APAGAIN
Line In Gain 02h	00000000b => +20 dB ... 00000101b => 0 dB ... 00001100b => -3 dB ... 00010001b => mute	RLIG, LLIG
Aux In Gain 03h	00000000b => +20 dB ... 00000101b => 0 dB ... 00001100b => -3 dB ... 00010001b => mute	AUXG
DAC Master Gain 04h	00000000b => +12 dB ... 00001000b => 0 dB ... 00001010b => -3 dB ... 00100000b => mute	RMPG, LMPG

Note: All audio gain value are described in AT83SND2CMP3 datasheet. Refer to register description for more details.

Player response to AUDIO_SET_GAIN is SYSTEM_ACK.

DAC Master Gain parameter can also be updated with :

- SYSTEM_VOLUME_UP command,
- SYSTEM_VOLUME_DOWN command.

Note: Player response to SYSTEM_VOLUME_UP or SYSTEM_VOLUME_DOWN command is PLAYER_VOLUME* Response. DAC Master Gain is Byte 5 in PLAYER_VOLUME* response.

AUDIO_PA_LP Set Player power amplifier (PA) Low power mode (for speaker) - Only in PLAY mode.

This command is used to set in a very short time the PA in a low power mode (only in play mode). A Play/Stop transition will reset the PA low power mode.

Table 5-54 . AUDIO_PA_LP command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	92h	01h	Byte 0: - 00h exit PA low power mode - 01h enter PA low power mode	Yes

Player response is SYSTEM_ACK or SYSTEM_NACK.

CUSTOM_SET_UART_BAUDR Custom change UART baudrate.
ATE Command

Default UART baudrate is 115200bps (physical baudrate 111111bps).

Table 5-55 . CUSTOM_SET_UART_BAUDRATE Command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	93h	03h	Byte 0: SCON_REG Byte 1: SMOD_SPD_REG Byte 2: BRG0_REG	Yes

Table 5-56 . Parameter Value / Baudrate

Baudrate	SCON_REG Value	SMOD_SPD Value	BRG0_VALUE
38400 bps	40h	03h	F3h
11500 bps	40h	02h	F7h

Player response is:

■ SYSTEM_ACK* frame at previous baudrate,

followed by:

■ SYSTEM_ACK* frame at new baudrate.

It is advised to send the SYSTEM_GET_STATUS after the baudrate change to confirm the change.

CUSTOM_GET_SYS_VERSIO Get Player AT83SND2CMP3 version "V2.0.0".
N Command

Table 5-57 . CUSTOM_GET_SYS_VERSION command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	94h	00h	No	Yes

Player response is CUSTOM_SYS_VERSION* frame.

CUSTOM_SYSTEM_SLEEP Command   Ask the Player to enter in power down mode (keep audio capacitors charged).

Note: To avoid any extra-power consumption in power down mode because of keeping audio capacitors charged, refer to SYSTEM_POWER_DOWN command.

Table 5-58 . CUSTOM_SYSTEM_SLEEP command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	95h	00h	No	Yes

CUSTOM_VOLUME   Set volume for DAC master playback gain (analog volume).

This command is the same as the AUDIO_SET_GAIN (DAC Master Gain 04h).

Table 5-59 . CUSTOM_VOLUME command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	F0h	01h	Byte 0: Gain Value	Yes

Note: Refer to AUDIO_SET_GAIN command description for Gain Value.

Player response is SYSTEM_ACK or SYSTEM_NACK.

CUSTOM_GETTOTALTIME Command   Get MP3 file total play time.

Note: The player response is only right whend MP3 file is Constant bit rate MP3.

Table 5-60 . CUSTOM_GETTOTALTIME Command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	F1h	00h	No	Yes

Player response is CUSTOM_TOTALTIME* frame.

CUSTOM_PLAYER_LAST Command   Go to the last file of current directory .

Table 5-61 . CUSTOM_PLAYER_LAST Command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	F4h	00h	No	Yes

Player response is SYSTEM_ACK or SYSTEM_NACK.

CUSTOM_PLAYER_FIRST Command Go to first file of current directory .

Table 5-62 . PLAYER_FIRST Command

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	F3h	00h	No	Yes

Player response is SYSTEM_ACK or SYSTEM_NACK.

5.6 Player's Response Frame

SYSTEM_ACK Response * The SYSTEM_ACK frame is the AT83SND2CMP3 frame response to Remote Controller for any completed command. This response have the current player status at this time. For every operating mode change, the Remote Controller shall check the Player's status.

Table 5-63 . General SYSTEM_ACK Frame

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	80h	01h	Byte 0 :Player Status Byte	Yes

SYSTEM_NACK Response * The SYSTEM_NACK frame is the AT83SND2CMP3 frame response to Remote Controller to any not completed command.

Table 5-64 . General SYSTEM_NACK Frame

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	81h	01h	Byte 0: Player Status Byte	Yes

FS_NAME Response * The FS_NAME frame is sent in case of Remote Controller FS_GET_NAME Command, SYSTEM_NAME response is in the following format:

Table 5-68 . FS_FREAD_BLOCK_DATA Frame

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum	Data Block
7Eh	If not used, FFh	84h	01h	DataBlockNumber 01h	Yes	Byte 0:1FFh => 512 Bytes data (no checksum on data)

FS_FREAD_BLOCK_DATA_EN D* Response Player Response of FS_READ_BLOCK command when last block is reached (end of file). After this Player reponse, there is no need to send the FS_FCLOSE command. Player returns in operating mode IDLE.

Table 5-69 . FS_FREAD_BLOCK_DATA_END Frame

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	85h	01h	Byte 0: Player Status Byte	Yes

PLAYER_INDEX_NUMBER* Response Player Response of PLAYER_GETINDEXNUMBER command. This frame returns the number of file in current directory.

Table 5-70 . PLAYER_INDEX_NUMBER Frame

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	86h	03h	Byte 0: Player Status Byte Byte 1: MSB(Number_of_Index) Byte 2: LSB(Number_of_Index)	Yes

FS_MEMFREESPACE* Response Player Response of FS_GETMEMFREESPACE command. Data parameter are:

■ number of free cluster (32 bits, byte 1:4, MSB is byte 0 in data parameters).

■ cluster size in sector (8 bits, byte 5 in data parameters).

Note: Sector size is 512 Bytes.

Memory free space available is :

    MemoryFreeSpace(Byte) = NumberFreeCluster * ClusterSize * 512 Bytes.

Table 5-71 . FS_MEMFREESPACE Frame

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	8Ah	06h	Byte 0: Player Status Byte Byte 1:4 Number of free cluster Byte 5: Cluster Size	Yes

FS_FILESIZE* Response Current file size is in Bytes. Player Response of FS_GETFILESIZE command.

Table 5-72 . FS_FILESIZE Frame

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	8Bh	05h	Byte 0: Player Status Byte Byte 1: MSB3 File size Byte 2: MSB2 File size Byte 3: MSB1 File size Byte 4: MSB0 File size	Yes

Note: File size is 4 bytes (MSB is byte 0). Directory size is 0.

FS_FILEPOS* Response   Player current file position (only in Player PLAY operating mode). The frame FS_FILEPOS returns 2 parameters:

- FCHAIN_INDEX: number of the fragment of the file, in fact the index of the table in the cluster chain (frame parameter byte 1).

- FLAST_CLUST_INDEX: index of the last cluster in file chain (frame parameter byte 2).

The File position is then given by the following formula:
```
FilePosition (%) = 100 * FCHAIN_INDEX / FLAST_CLUST_INDEX
```

Table 5-73 . FS_FILEPOSFrame

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	8Ch	03h	Byte 0: Player Status Byte Byte 1: FCHAIN_INDEX Byte 2: FLAST_CLUST_INDEX	Yes

PLAYER_END_OF* Response   Player has reached end of

- list after the PLAYER_GET_FILE_LIST command.

Table 5-74 . PLAYER_END_OF_LIST Frame

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	8Dh	02h	Byte 0: Player Status Byte 1: - 00h => reserved - 01h => End of list reached	Yes

SYSTEM_MOUNTED* Frame   Player has finished to select and install file system FAT on selected memory.

Example:

- Remote Controller sends the SYSTEM_SELECT_MEMORY command.

- When file system install is finished, the Player status is updated with: FNA or MNF or MERROR. The Player send the SYSTEM_MOUNTED frame.

AT83SND2CMP3 User Guide

Because that the memory selection can happens even without the SYSTEM_SELECT_MEMORY command, it is possible that the AT83SND2CMP3 will send the SYSTEM_MOUNTED frame in the following case:

- USB attach (reselect default memory before USB enumeration).
- USB detach (reselect default memory and install FAT on it).

Table 5-75 . SYSTEM_MOUNTED Frame

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	8Fh	01h	Byte 0: Player Status	Yes

CUSTOM_PLAYER_TOTALTIME* Frame

Total time playable of MP3 file.

Player response to CUSTOM_PLAYER_GETTOTALTIME command.

Note: the player response is only right whend MP3 file is CBR (Constant Bit Rate) encoded MP3. When it is a VBR (Variable Bit Rate) encoded MP3, this information is wrong.

Table 5-76 . CUSTOM_PLAYER_TOTALTIME Frame

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	E0h	00h	Byte 0: Player Status Byte 1: Minute Byte 2: Second	Yes

CUSTOM_PLAYER_END_OF_FILE* Frame

This frame is sent when end of file is reached in playing mode.

This frame is a player response and is sent to notify Remote Controller that end of current playing file is reached.

Table 5-77 . CUSTOM_PLAYER_END_OF_FILE Frame

Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	E1h	04h	Byte 0: Player Status Byte 1: 'E' (45h) Byte 2: 'N' (4Eh) Byte 3: 'D' (44h)	Yes

CUSTOM_SYS_VERSION* Frame

This frame is the response to CUSTOM_GET_SYS_VERSION command.

Table 5-78 . CUSTOM_PLAYER_END_OF_FILE Frame

| Frame Start	Channel	Protocol Command	Data Length	Data	CheckSum
7Eh	If not used, FFh	E3h	06h	Byte 0: Player Status Byte 1: 'V' (56h) Byte 2: '2'(31h) Byte 3: '.'(2Eh) Byte 4: '0'(36h) Byte 5: '.'(2Eh) Byte 6: '0'(36h)	Yes

Section 6

Technical Support

For Technical support, please contact mcu@atmel.com. When requesting technical support, please include the following information:

- Target voltage and speed
- Hardware revisions of the tools,
- PC operating system and version/build
- PC processor type and speed
- A detailed description of the problem

P3.7
P3.6
P3.5
P3.4
P3.3
P3.2
P3.1
P3.0

TST#
SDA
SCL
KIN0
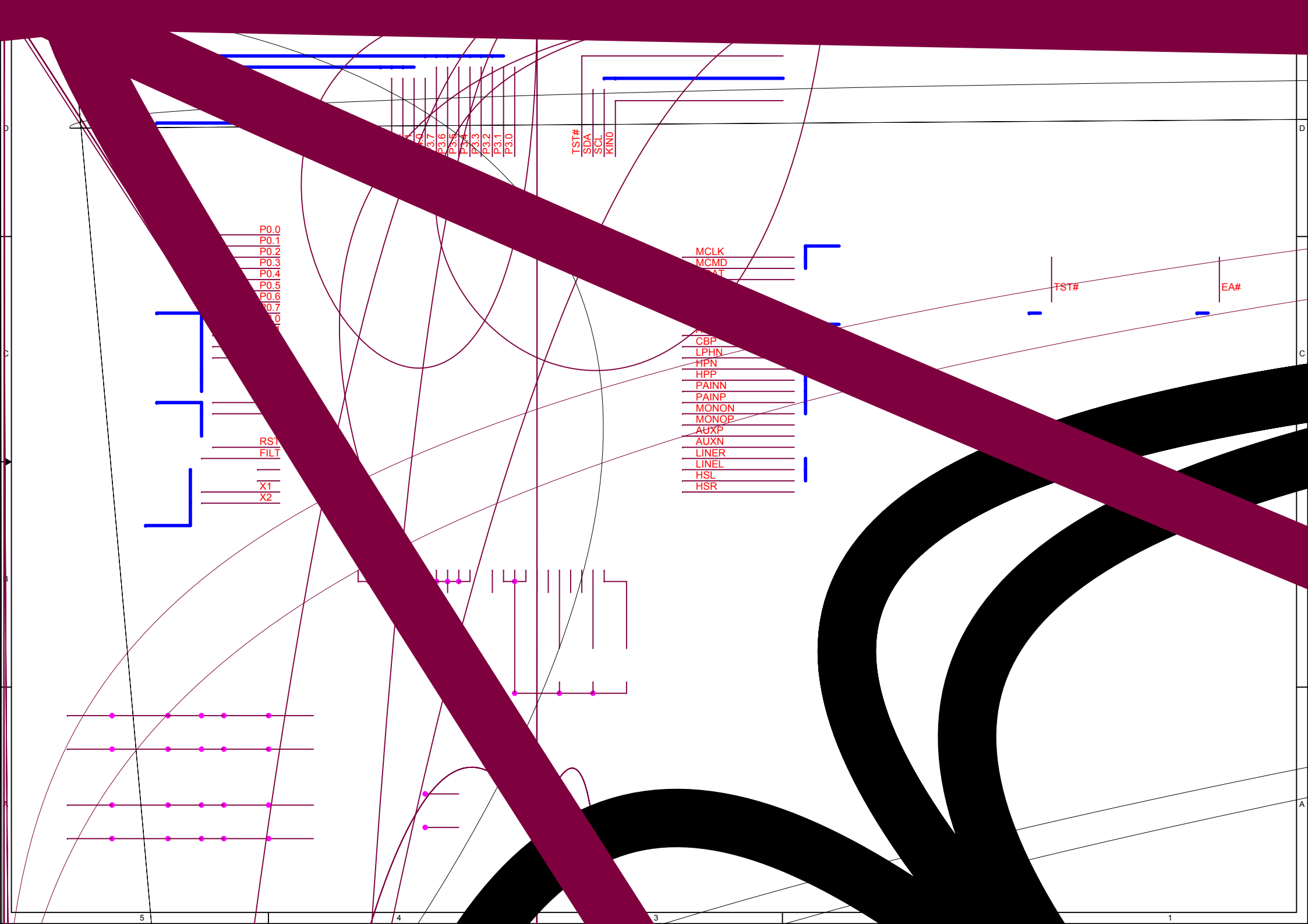
P0.0
P0.1
P0.2
P0.3
P0.4
P0.5
P0.6
P0.7

MCLK
MCMD
MDAT
CBP
LPHN
HPN
HPP
PAINN
PAINP
MONON
MONOP
AUXP
AUXN
LINER
LINEL
HSL
HSR

RST
FILT
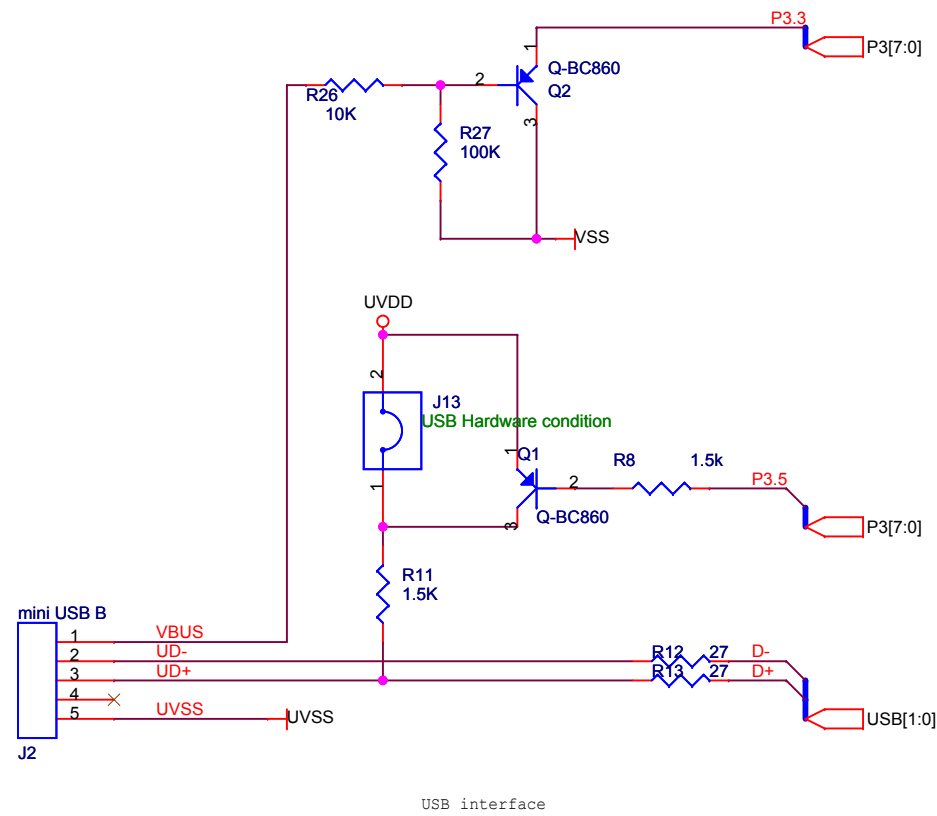
X1
X2

TST#

EA#

D

C

B

A

5
4
3
1

J14
1   2
POWER SELECTOR

D1   1N4002

U2
VIN   VOUT
ADJ   VOUT
LM317-EMP

J1
2
1
CONNECTOR SIP2
DC POWER SUPPLY 5V to 9V

VCC5 (5V to 9V)

3   2
4

VCC3

CP1   VDD
Configuration Pad
CP2   PVDD
Configuration Pad
CP3   UVDD
Configuration Pad
CP4   AUDVDD
Configuration Pad
CP5   AUDVBAT
Configuration Pad
CP6   HSVDD
Configuration Pad

R2
680

R3
68

C24 +
100u TANTAL

D2
1N4002

C25 +
100u TANTAL

C26
+
100n

R4
470

D3
POWER-ON
LED PWR RED

VSS
PVSS
UVSS
AUDVSS
ESDVSS
HSVSS

Warning:
1. To prevent system malfunctions during periods of insufficient power supply voltage, AT8xC51SND2C
voltage supply shall be monitored by a voltage supervisor.
2. During USB operation, AT8xC51SND2C voltage supply shall be 3.0 V to 3.6V to comply USB specification.
3. AUDVBAT (Audio power amplifier supply) shall be connected to Battery supply (at least 3.2V).

Title
Power supply

Size
A

Document Number
AT83SND2MP3 - Reference board

Rev
3.1

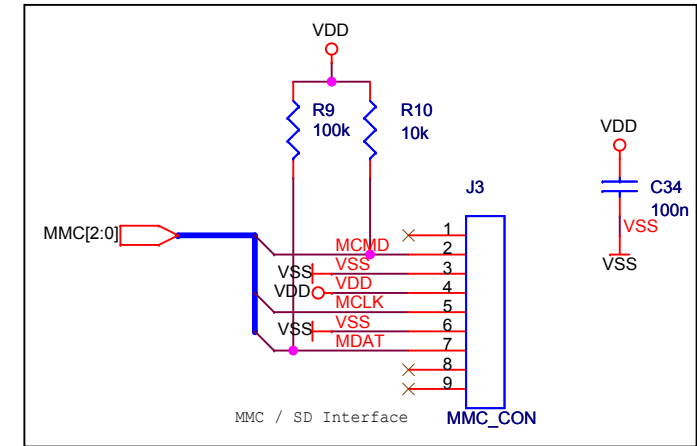Date: Friday, May 27, 2005   Sheet   2   of   6

CPU RESET

AUDIO RESET

VDD

C27
1u

EXT_ACCESS[3:0]

TWI[1:0]

AUDIO[18:0]

SW2
RESET
PUSHBUTTON

VDD

RST

SDA

R7

0

AUDRST

R5
10K

D4
1N4148

VSS

VSS

FILT

CLOCK[2:0]

R6
100

C30
2.2n

C31
10n

PVSS

PLL filter

C32

X1

VSS

33p
C33

Y1
16 MHz

CLOCK[2:0]

VSS

33p

X2

CPU CLOCK
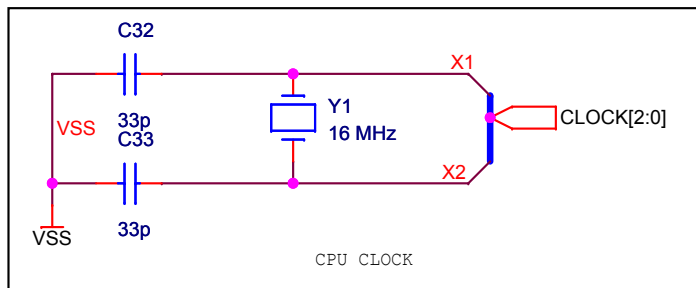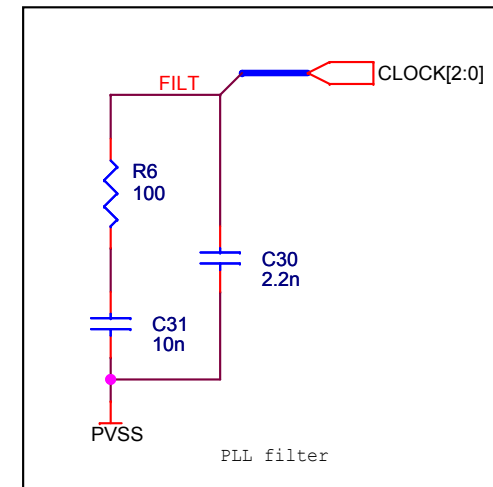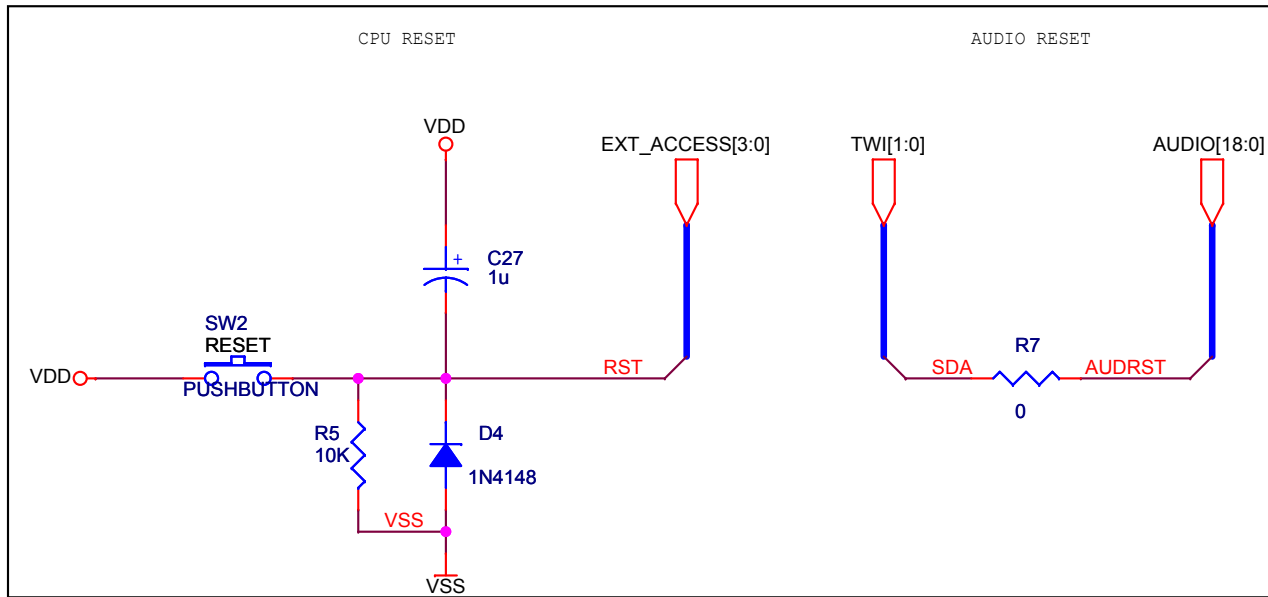
Title
Clock & Reset

Size
A

Document Number
AT83SND2MP3 - Reference board

Rev
3.1

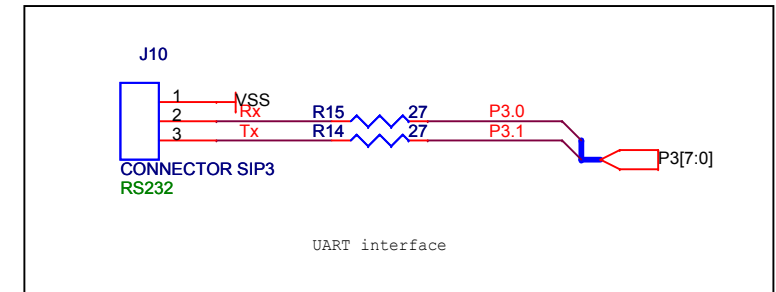Date: Friday, May 27, 2005   Sheet   3   of   6

VDD

R9
100k

R10
10k

VDD

C34
100n

VSS

VSS

MMC[2:0]

J3

MCMD   1
VSS   2
VSS   3
VDD   4
VDD   MCLK   5
VSS   6
VSS   MDAT   7
8
9

MMC / SD Interface   MMC_CON

P3.3

P3[7:0]

Q-BC860
Q2

R26
10K

2

1

3

R27
100K

VSS

UVDD

2

J13
USB Hardware condition

1

Q1

1

R8   1.5k

2

P3.5

P3[7:0]

Q-BC860

3

R11
1.5K

mini USB B

J10

1   VSS
2   Rx
3   Tx

R15   27   P3.0
R14   27   P3.1

P3[7:0]

CONNECTOR SIP3
RS232

UART interface

1   VBUS
2   UD-
3   UD+
4
5   UVSS

UVSS

R12   27   D-
R13   27   D+

USB[1:0]

J2

USB interface

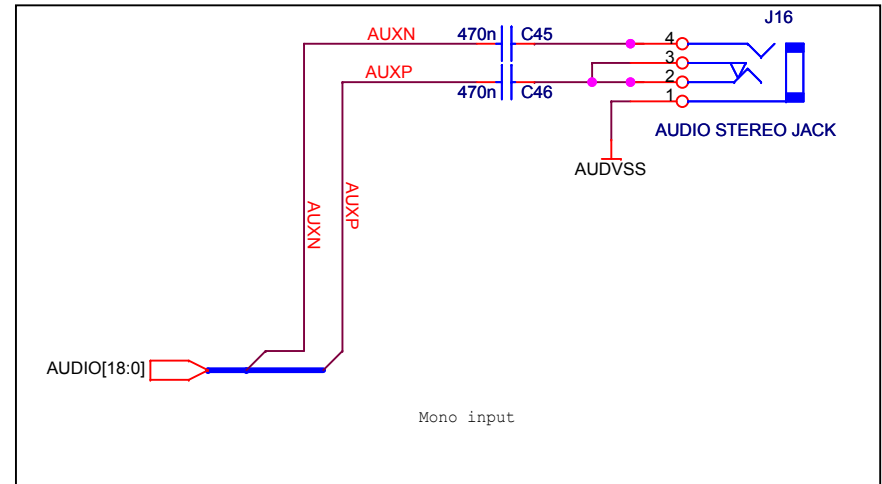During USB operation, AT8xC51SND2C voltage supply shall be 3.0 V to 3.6V to comply USB specification.

Title	Standard Interfaces		
Size A4	Document Number AT83SND2MP3 - Reference board		Rev 3.1
Date:	Friday, May 27, 2005	Sheet	4 of 6

AUDIO OUPUTS

Head Set output

J6

4
3
2
1

AUDIO STEREO JACK

C36   100u TANTAL   HSR
C38   HSL
       100u TANTAL

AUDVSS

AUDIO[18:0]

Mono input

AUXN   470n C45
AUXP
        470n C46

4
3
2
1

J16

AUDIO STEREO JACK

AUDVSS

AUXN
AUXP

AUDIO[18:0]

AUDIO MONO JACK

1
2
3

J17

HPP
HPN

R18   200   LPHN

C40   PAINN
470n   MONON

C41   PAINP
470n   MONOP

AUDVBAT

AUDVSS C42 22u   AUDVBAT

AUDVSS C43 100n CBP

Speaker

AUDIO[18:0]

J12

3
2
1

AUDIO MONO JACK

C47 470n   LINEL

AUDVSS

J15

3
2
1

AUDIO MONO JACK   AUDVSS

C48 470n   LINER

AUDIO[18:0]

Line inputs (stereo)

Title	Audio Interfaces		Rev
Size A4	Document Number AT83SND2MP3 - Reference board		3.1
Date:	Thursday, May 26, 2005	Sheet 5 of 6	

P0[7:0]

VDD VDD

VSS   VSS

P2[7:0]

P2.0   16 CLE
P2.1   17 ALE
P2.7   9   /CE
P3.7   8   /RE
P3.6   18 /WE
        19 /WP
        7   RDY/B

P3[7:0]

36 VSS
12 VCC
37 VCC

29 IO0 P0.0
30 IO1 P0.1
31 IO2 P0.2
32 IO3 P0.3
41 IO4 P0.4
42 IO5 P0.5
43 IO6 P0.6
44 IO7 P0.7

SCL

P2.3

TWI[1:0]

P2[7:0]

Nand Flash connection :
P3.6 : WR#
P3.7 : RD#
P2.0 : CLE
P2.1 : ALE
SCL: WP#. NandFlash WP# pin signal shall
    be pull down (47K ohms) and connected to
    AT8xC51SND2C SCL (from TWI[1:0] bus).
P2.3 : RDY/BUSY
P2.7 : CE#

Changes
#######
v3.1.0, 27 May, 2005
-First Release of AT83SND2MP3 schematics based on AT89RFD-08
reference board.

####

TIPS
####
For debugging purpose, it is recommend to add testpoints on the following signals:
- ALE
- RST
- UART RX and TX
- PSEN
Refer to Hardware Guide for Layout Rules
####

Title
NandFlash

Size   Document Number   Rev
A4   AT83SND2MP3 - Reference board   3.1

Date: Friday, May 27, 2005   Sheet   6   of   6

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