

**AT83SND2CMP3**

.....  
**User Guide**





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# Section 1

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## 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





## Section 2

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# 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:

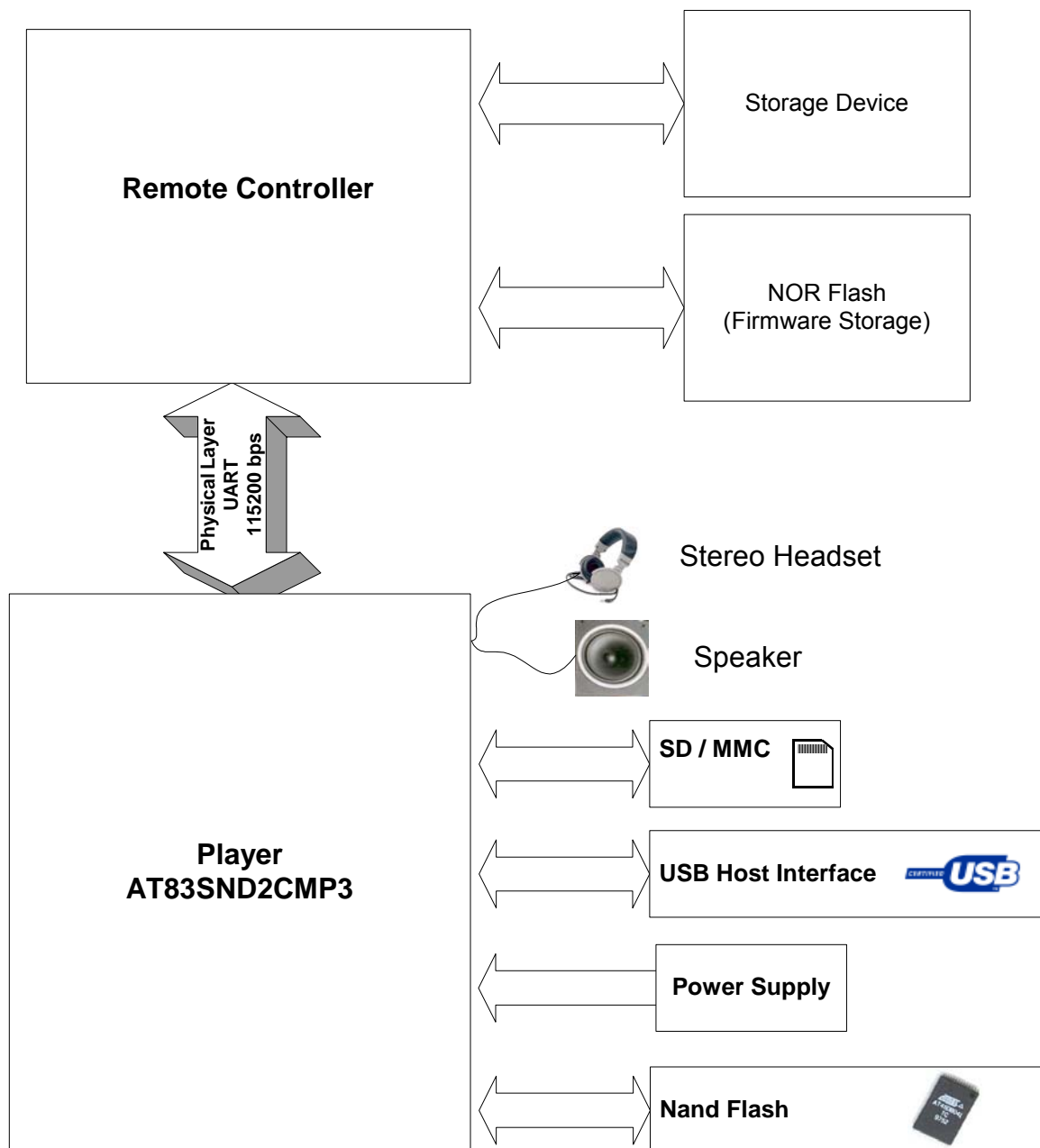
- MP3 music playing capability
  - from Nand Flash (512Byte page size)
  - from MMC or SD card,
- Embedded FAT 12/16/32.
- The AT83SND2CMP3 can be remote controlled from an external Controller using standard commands such as:
  - Play, stop, pause, next, previous,
  - Select memory,
  - File System Navigation,
- 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



## Functional Description

- 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

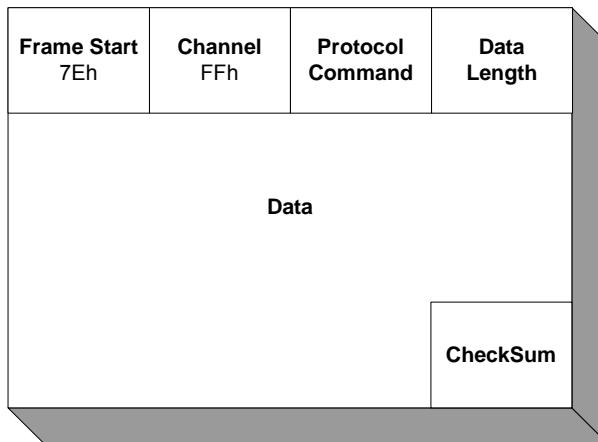
The AT83SND2CMP3 is remotely controlled using simple ‘user interface like’ commands such as Play or Stop commands. The communication protocol provides an abstraction of the physical layer between the Remote Controller and the Player.

**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: <ul style="list-style-type: none"> <li>• Headset</li> <li>• Headset and Power Amplifier</li> </ul>
SYSTEM_SELECT_MEMORY	04h	1 Byte	Select Memory on: <ul style="list-style-type: none"> <li>• NandFlash (NF)AT83SND2CMP3</li> <li>• Card (SD/ MMC) connected to AT83SND2CMP3</li> </ul> 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: <ul style="list-style-type: none"> <li>Repeat / No Repeat</li> <li>Play Single</li> <li>Play Dir</li> <li>Play Disk</li> <li>Explorer Mode (see all file type for file transfer)</li> </ul>
SYSTEM_AUDIO_INPUT	0Eh	1 Byte	Enable Player Audio Input <ul style="list-style-type: none"> <li>None - disable selected input</li> <li>Mono Input</li> <li>Stereo Input</li> </ul>
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 detected 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

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.

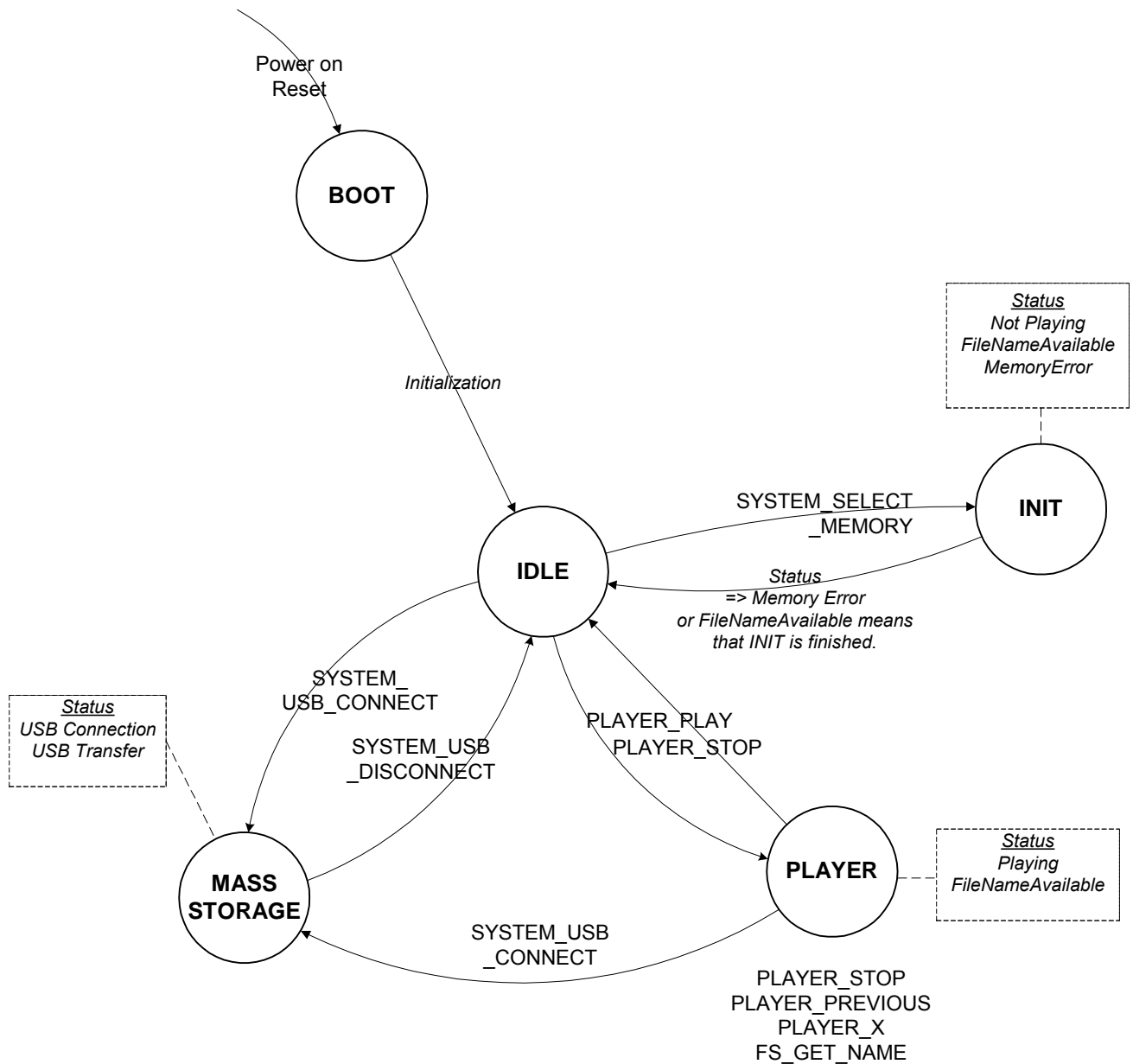
Notes: 1. \* means that the frame is a Player Response to Remote Controller request.



### 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 occurred, 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, except 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 <code>TimeResumeCommand</code> 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).

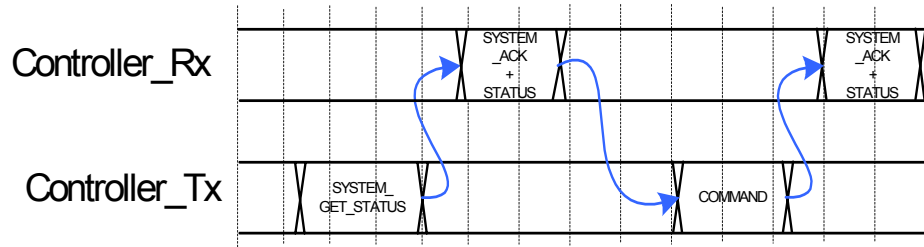
Note: To connect Remote Controller and AT89RFD-08 boards, please refer to Hardware User's Guide Boards and check Rx and Tx signals are crossed for each board.

**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.

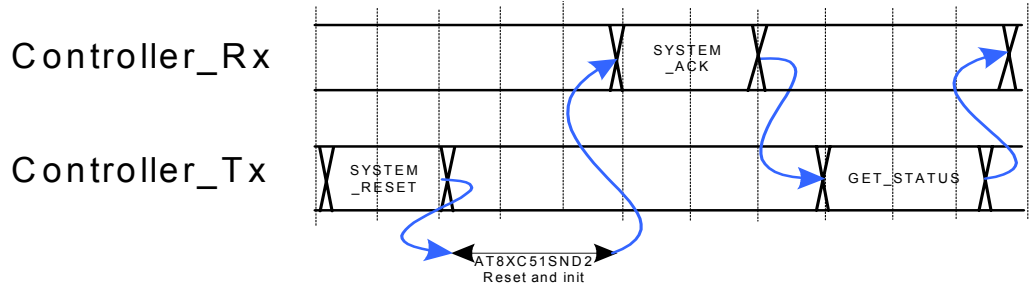
Figure 3-3. Protocol communication principle of use



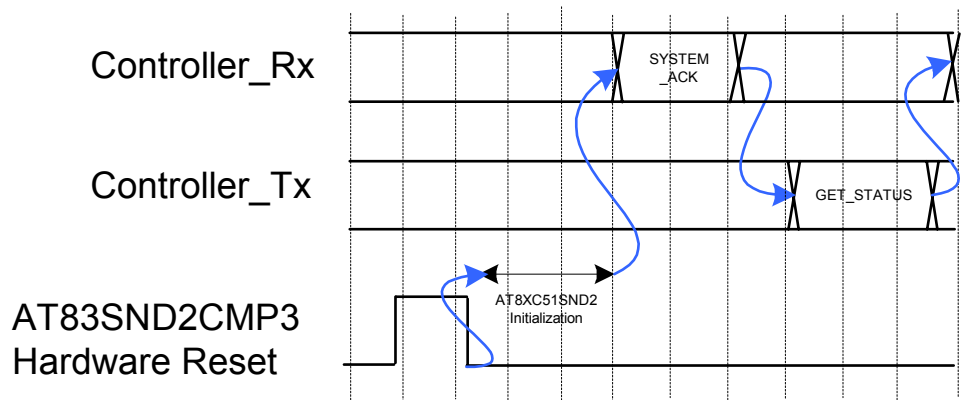
### 3.7 Player Management

**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.

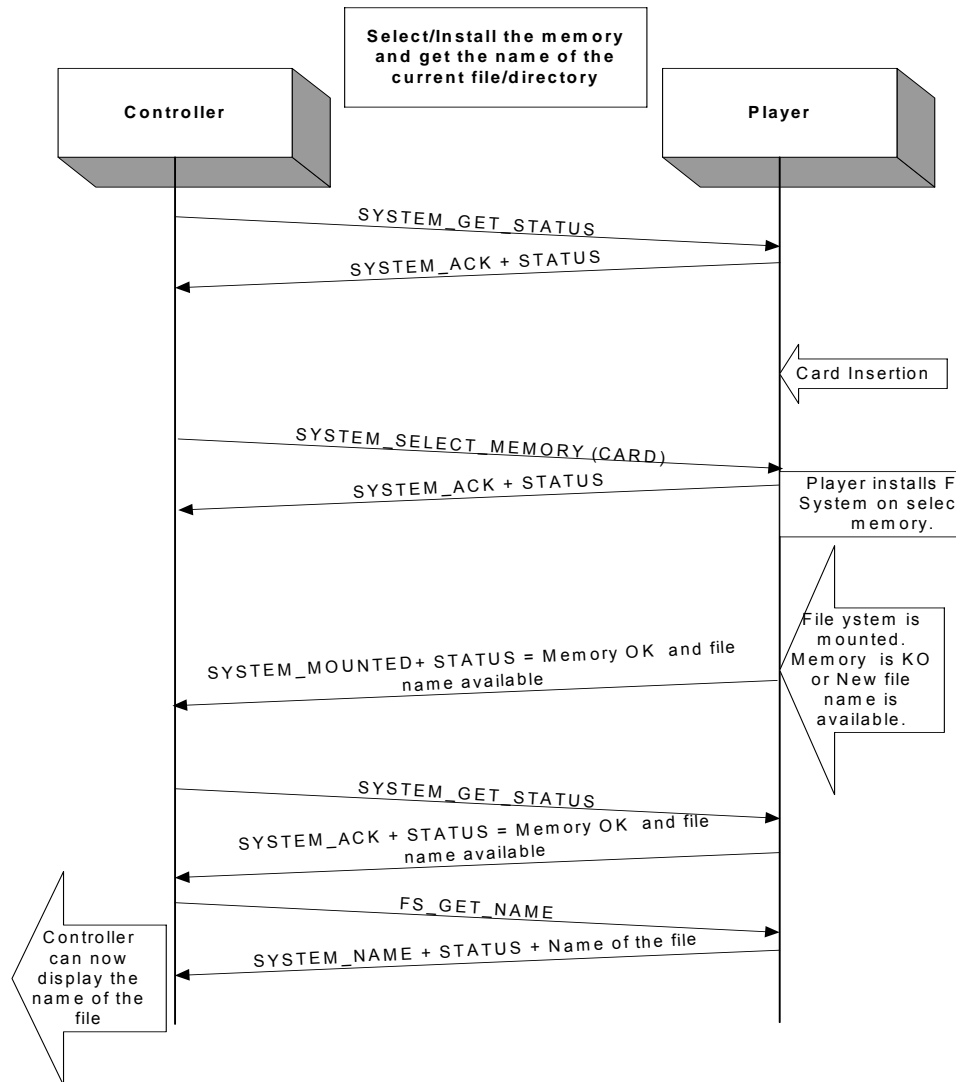
The Player's Status Byte contains informations like:

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

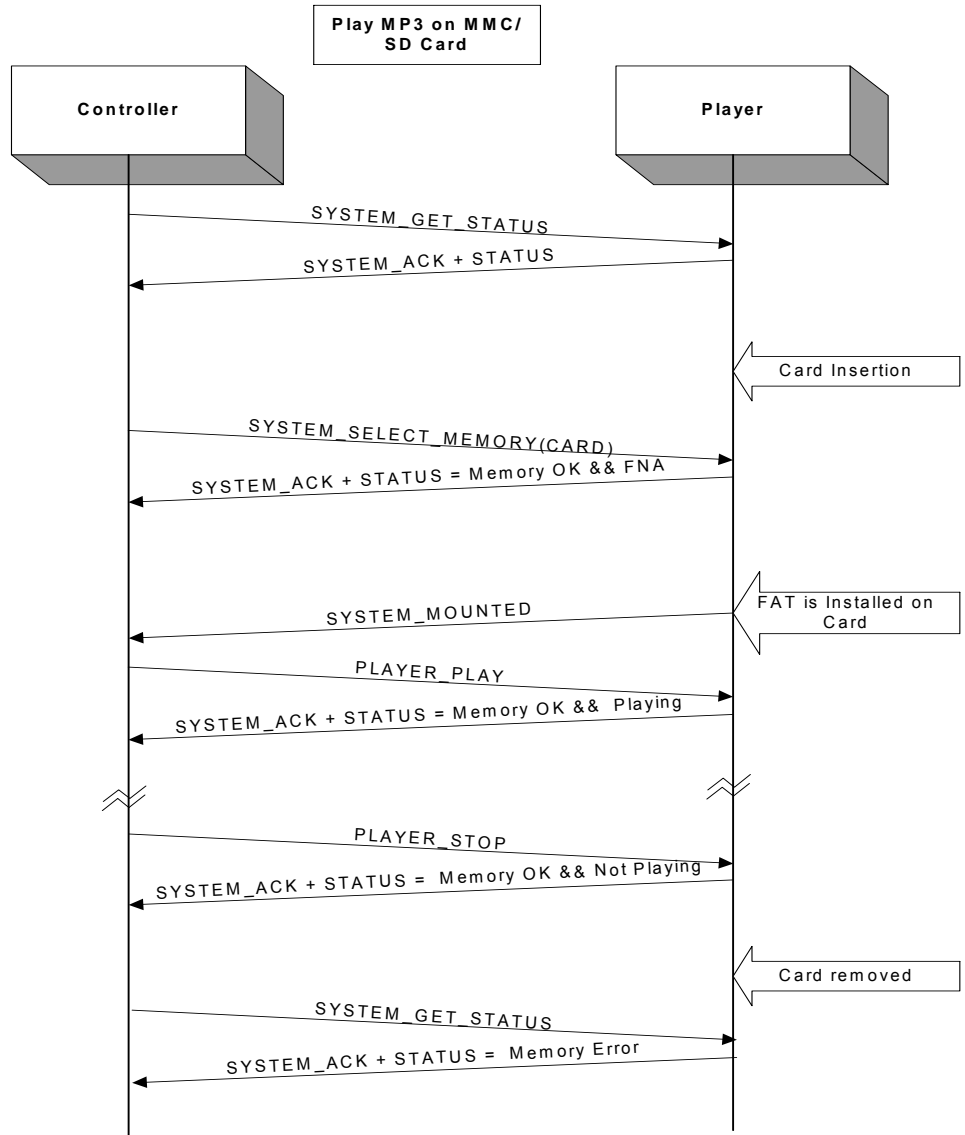
The SYSTEM\_ACK\_STATUS frame response is the acknowledge for the received frame and the corresponding command processed.

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

Example 1 **Table 3-8** . Example: select memory and get name of current file

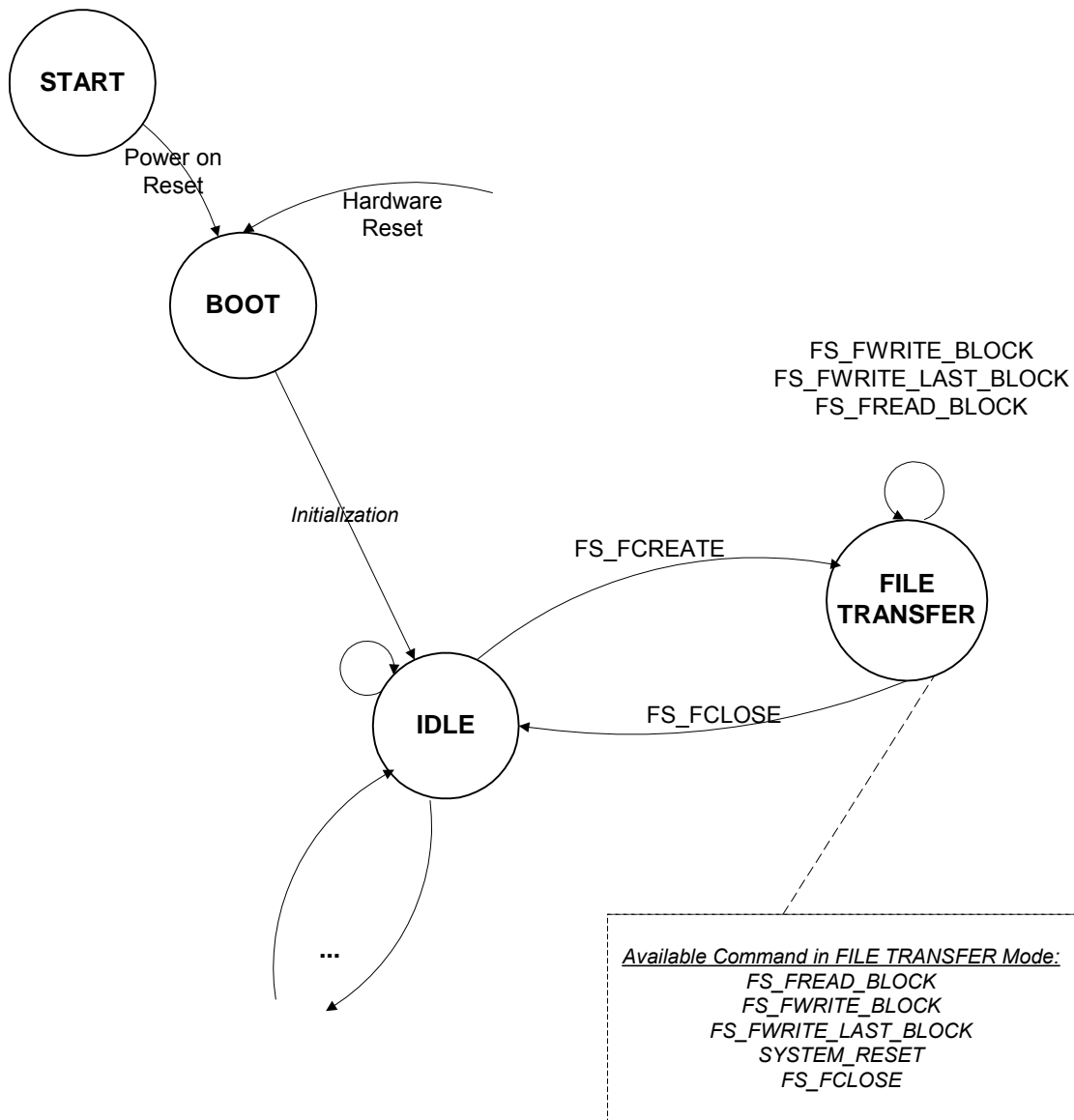


Example 2 **Figure 3-5** . Example: Play a MP3 file



## 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

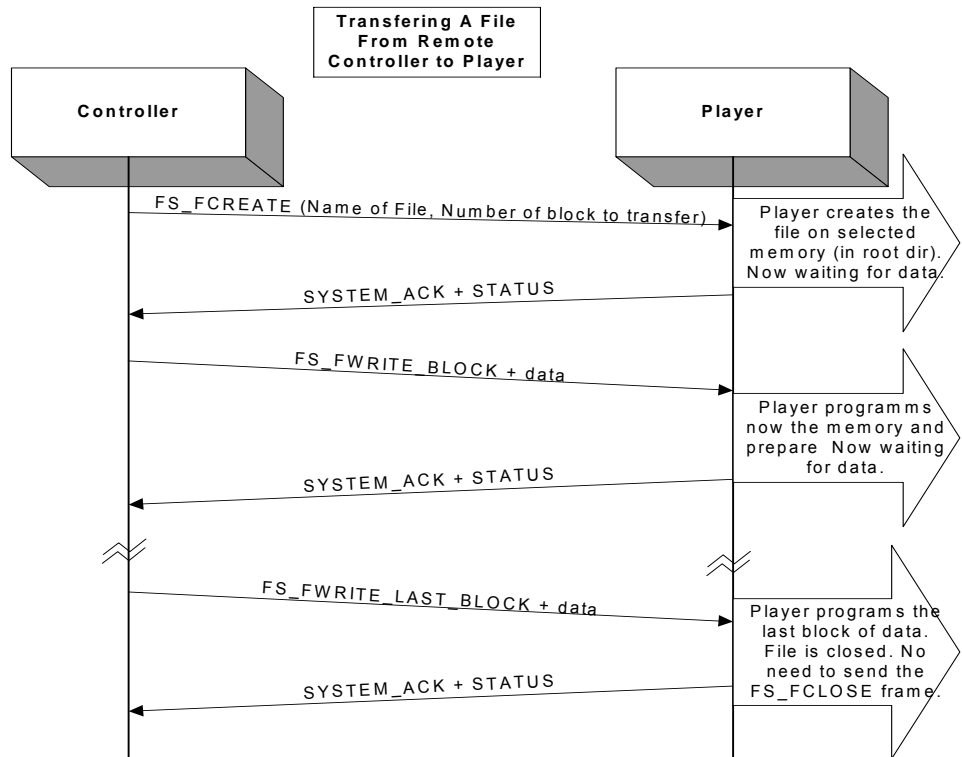
The following commands:

- 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\_BLOCK or FS\_FCLOSE are allowed to finish the file transfer because the AT83SND2CMP3 is an optimized transfer mode.

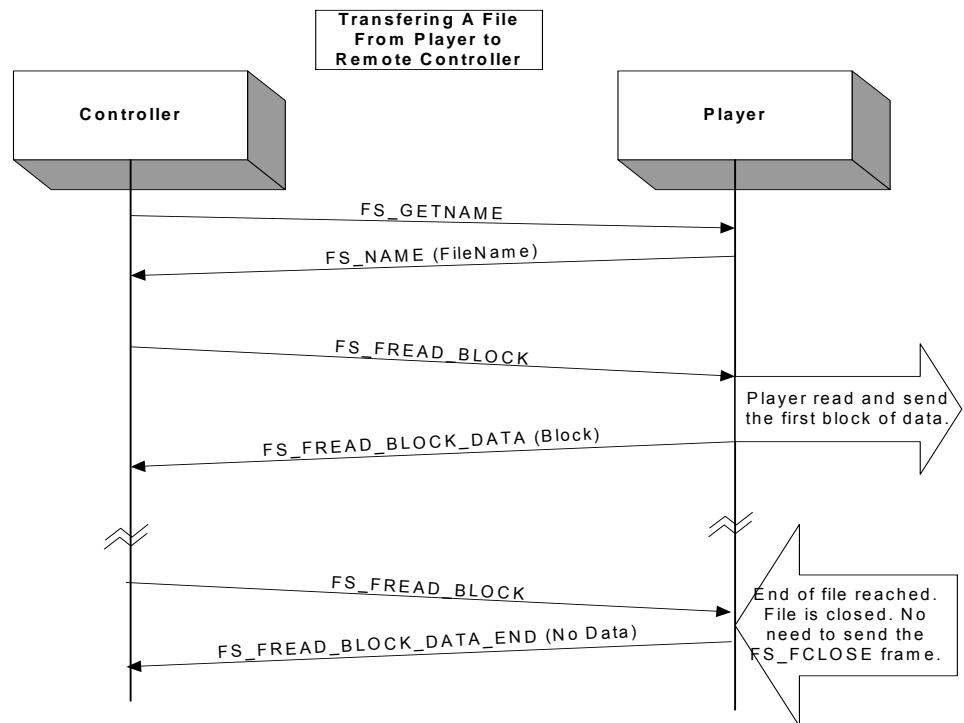
To create the file "wr\_test.mp3" (total size 1312 Bytes: 2 block of 512 bytes + last block 288 bytes):

- 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.



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

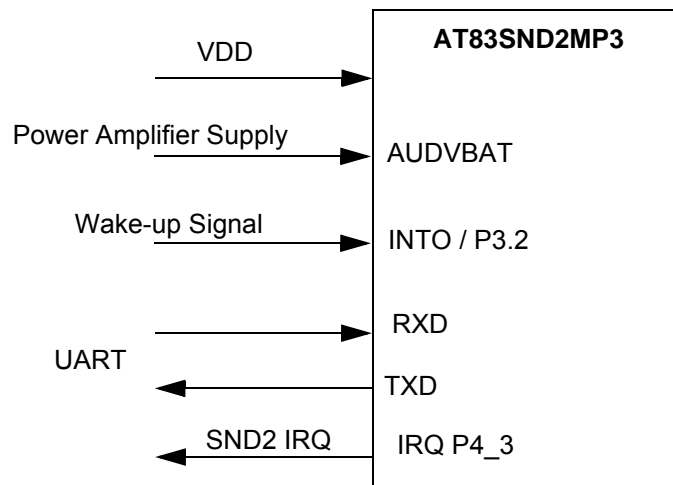
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## Design

### 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](mailto: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 units 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.

---

## 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	<b>OPM</b>	<b>Operating Mode</b> This bit is set when playing music. This bit is cleared when Player is in idle mode (not playing)
6	<b>ERROR</b>	<b>Command Error</b> 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	<b>MERROR</b>	<b>Memory Error</b> This bit is set when selected memory is KO This bit is cleared when selected memory is OK.
4	<b>MNF</b>	<b>Memory Not Formated</b> This bit is set when selected memory is not formated. This bit is cleared when selected memory is OK.
3	<b>USB_CON</b>	<b>USB Connection</b> This bit is set when an USB connection occurred. This bit is cleared when there is no USB connection.

Bit Number	Bit Mnemonic	Description
2	<b>USB_TRANS</b>	<b>USB Transfer</b> This bit is set when an USB data transfer is being processed. This bit is cleared when there is no USB transfer.
1	<b>Reserved</b>	<b>Reserved.</b>
0	<b>FNA</b>	<b>File name available.</b> 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	<b>USB Number of logical unit</b> - for Nand flash only: 01h - for MMC/SD card only: 02h - for Nandflash and MMC/SD card: 03h
Byte 1:2	<b>USB Vendor ID</b> Atmel VID is 03EBh (default value) Byte 1: MSB(VID) Byte 2: LSB(VID)
Byte 2:3	<b>USB Product ID</b> 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 formatted, Table 5-1 . Player STATUS Description). This flag is set when selected memory is not formatted.

**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: <ul style="list-style-type: none"> <li>On-Board Player Memory (Nand Flash)</li> <li>Card (SD/ MMC card)</li> </ul>	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

**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).

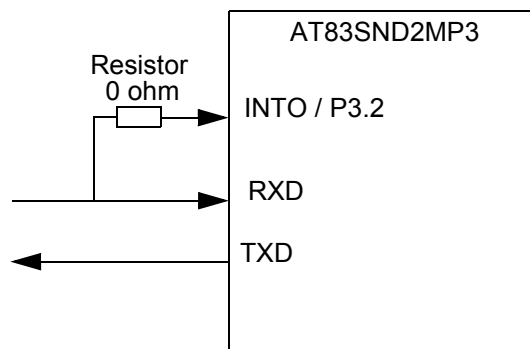
**SYSTEM\_WAKEUP Command** SYSTEM\_WAKEUP Command is a special command: it is 1ms (at least) of logical level "0" on AT83SND2CMP3 GPIO INTO.

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.

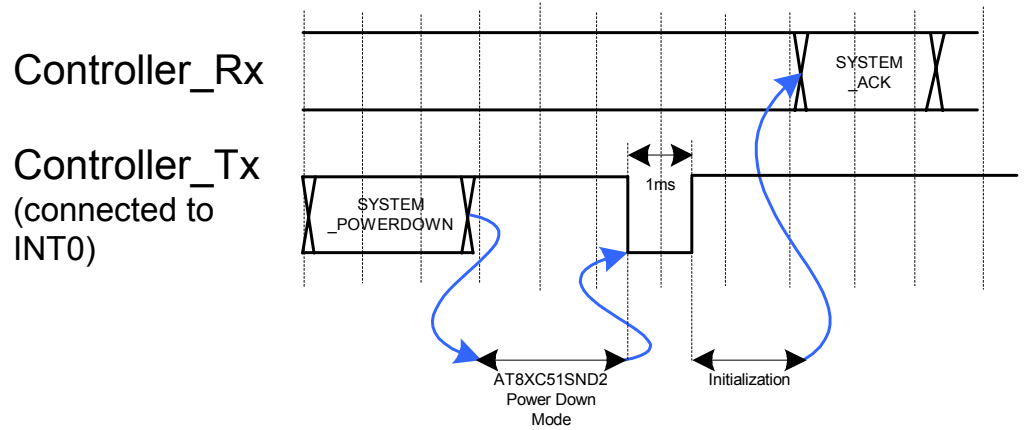
AT83SND2CMP3 UART is not active in Power down mode.

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	<b>Repeat Mode</b> Clear for no repeat mode. Set for repeat mode.
6:5	-	<b>Reserved</b>
4:2	FILETYP	<b>Player File type</b> 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	<b>Play mode.</b> 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

**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).

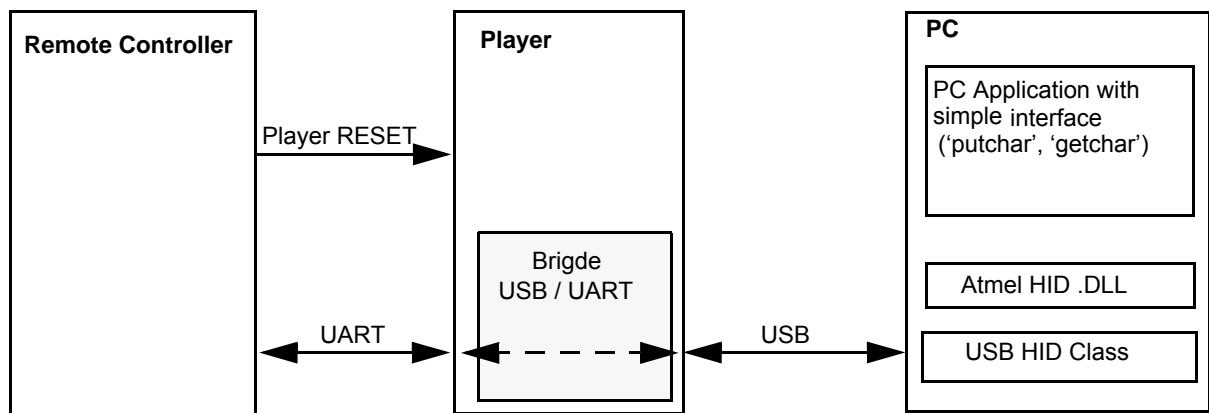
When connected in this way, the Player acts only as USB-UART bridge. This mode allow the Remote Controller to send and receive any binary/protocol information from/to UART.

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** Get numbers of files in current directory or root directory.  
*Command*

**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** 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).  
*Command*

**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** 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.  
*Command*

**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** Get file name list in current directory or root directory.  
*Command*

**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).

**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 response 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\_WRITE\_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 transferred.

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
<b>Line Out Gain</b> 00h	00000000b => 0 dB ... 00000010b => -3 dB ... 00100000b => mute	LLOG, RLOG
<b>Power Amplifier Gain</b> 01h	00000000b => -22 dB 00000001b => +20 dB ... 00001000b => -1 dB 00001011b => -10 dB ... 00001111b => -22 dB	APAGAIN
<b>Line In Gain</b> 02h	00000000b => +20 dB ... 00000101b => 0 dB ... 00001100b => -3 dB ... 00010001b => mute	RLIG, LLIG
<b>Aux In Gain</b> 03h	00000000b => +20 dB ... 00000101b => 0 dB ... 00001100b => -3 dB ... 00010001b => mute	AUXG
<b>DAC Master Gain</b> 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\_VERSION** 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** Ask the Player to enter in power down mode (keep audio capacitors charged).

*Command* 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** Get MP3 file total play time.

*Command* 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** Go to the last file of current directory .

*Command*

**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 response, 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 :

$$\text{MemoryFreeSpace(Byte)} = \text{NumberFreeCluster} * \text{ClusterSize} * 512 \text{ Bytes.}$$

**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:

$$\text{FilePosition (\%)} = 100 * \text{FCHAIN\_INDEX} / \text{FLAST\_CLUST\_INDEX}$$

**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.



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* Total time playable of MP3 file.  
E\* Frame

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

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*\* This frame is the response to CUSTOM\_GET\_SYS\_VERSION command.  
Frame

**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



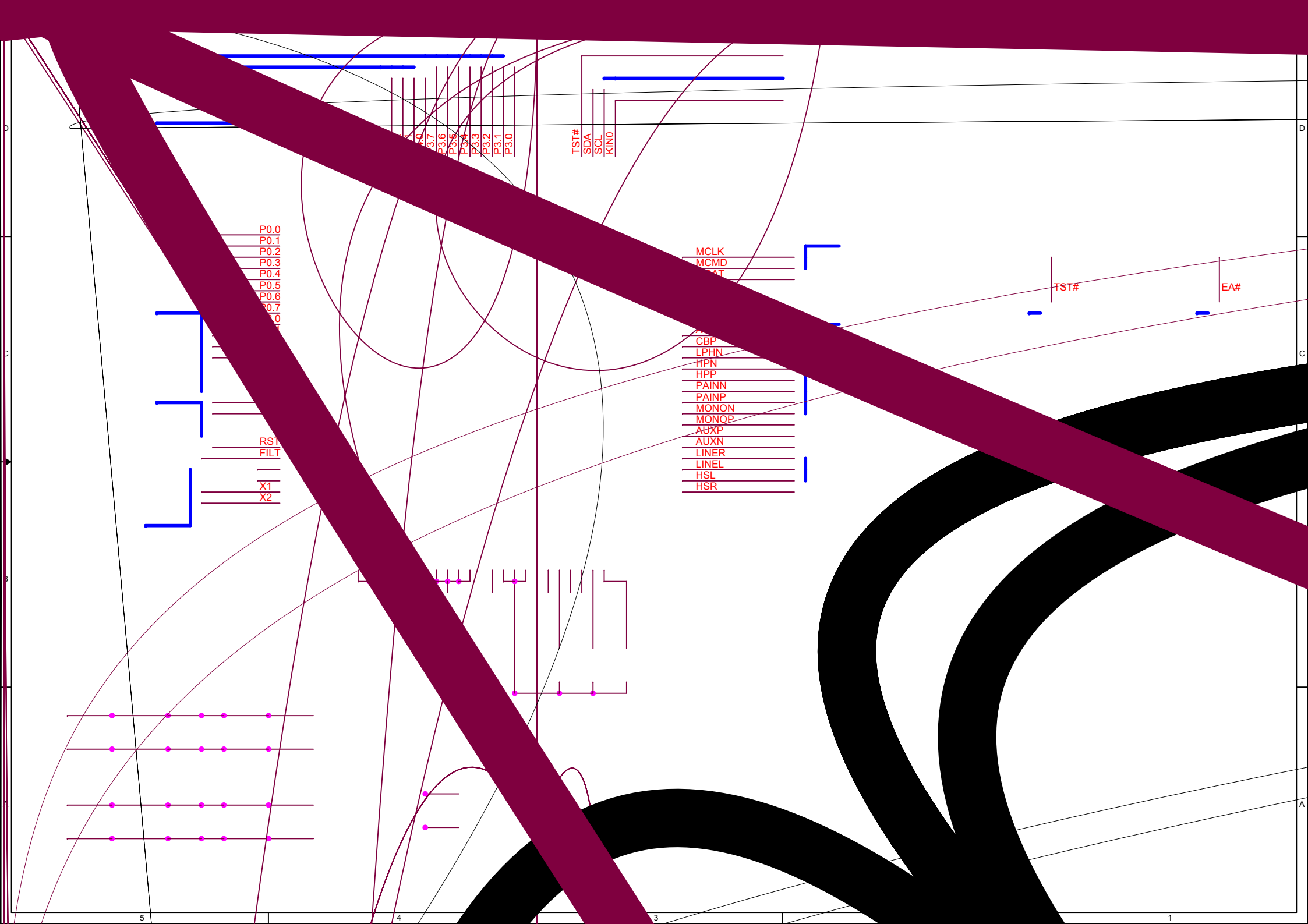
## Section 6

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# Technical Support

For Technical support, please contact [mcu@atmel.com](mailto: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



P0.0  
P0.1  
P0.2  
P0.3  
P0.4  
P0.5  
P0.6  
P0.7  
P0.0

RST  
FILT  
X1  
X2

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

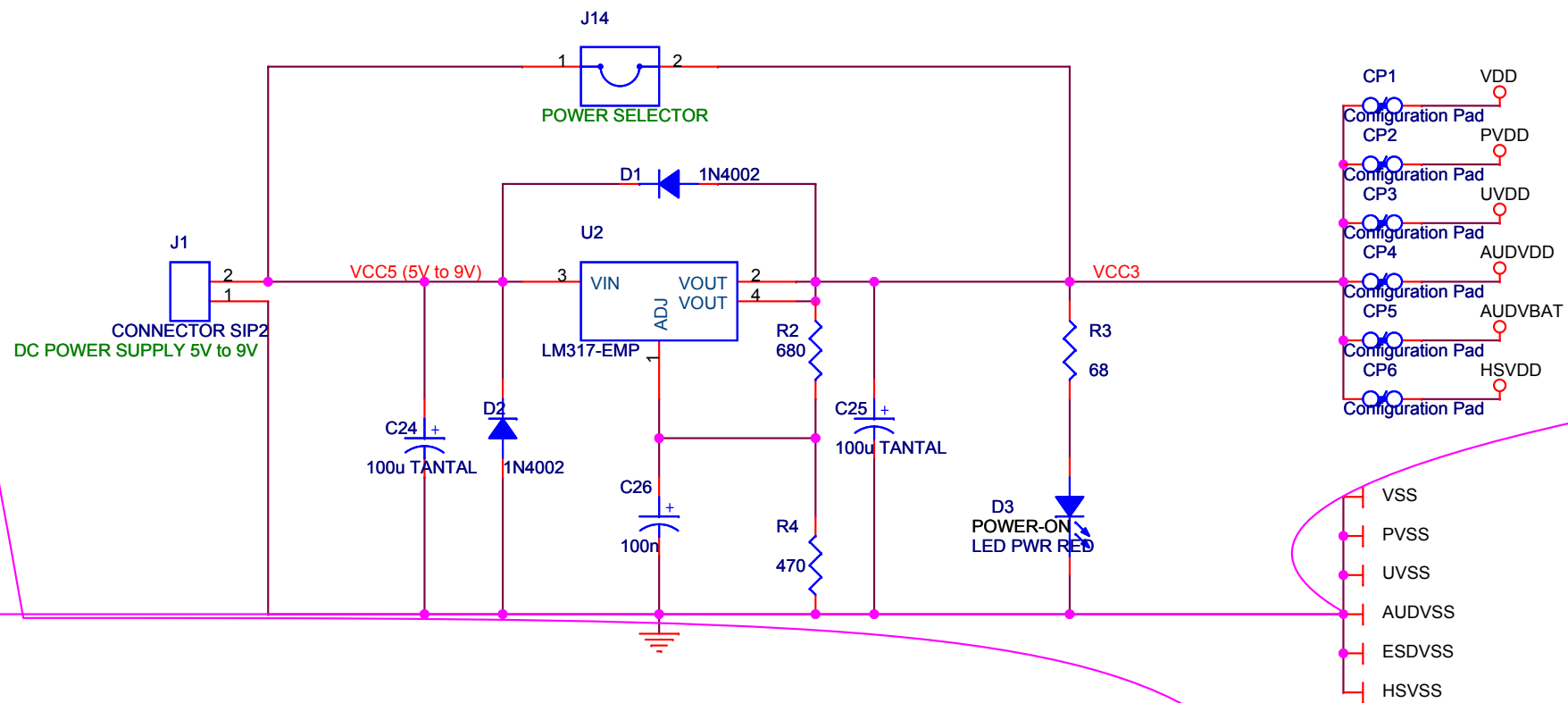
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SCL  
KINO

MCLK  
MCMD  
MSTAT

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

TST#

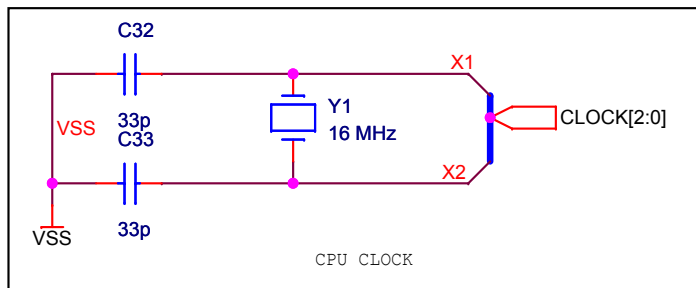
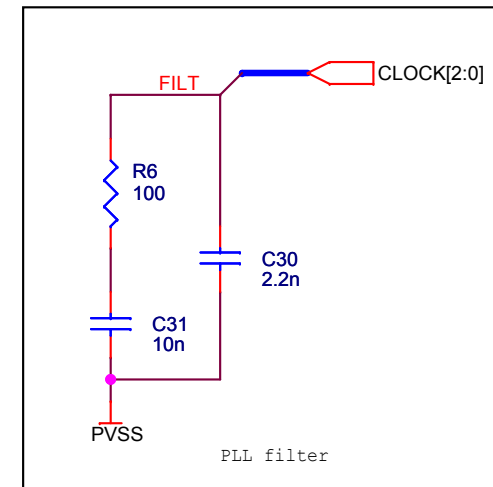
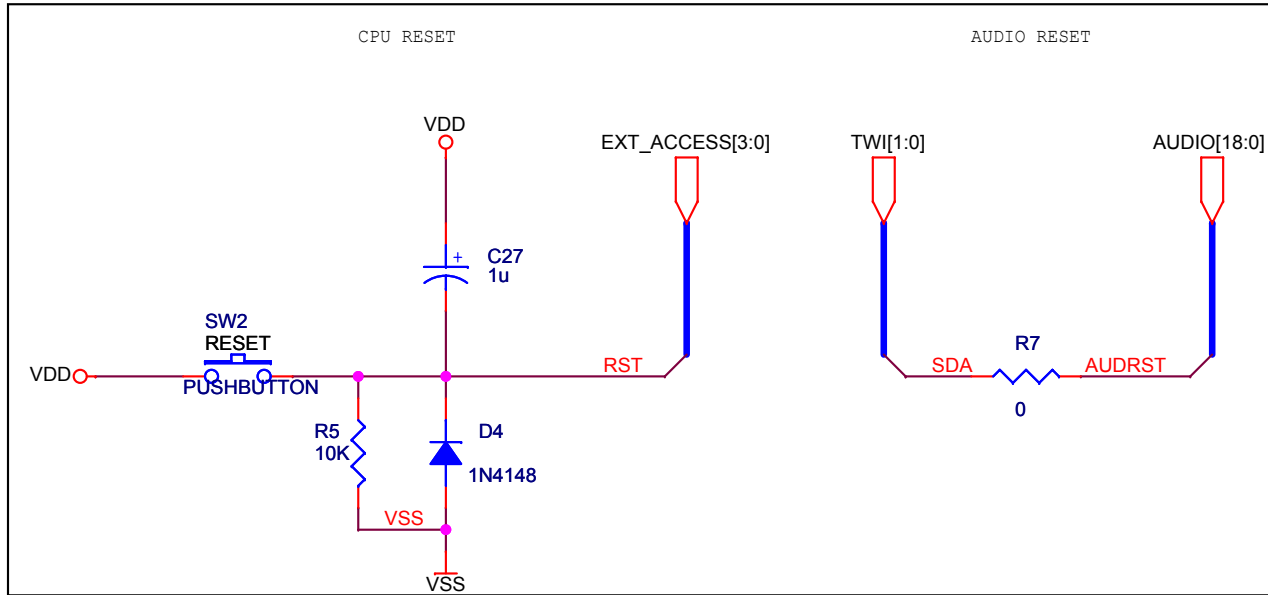
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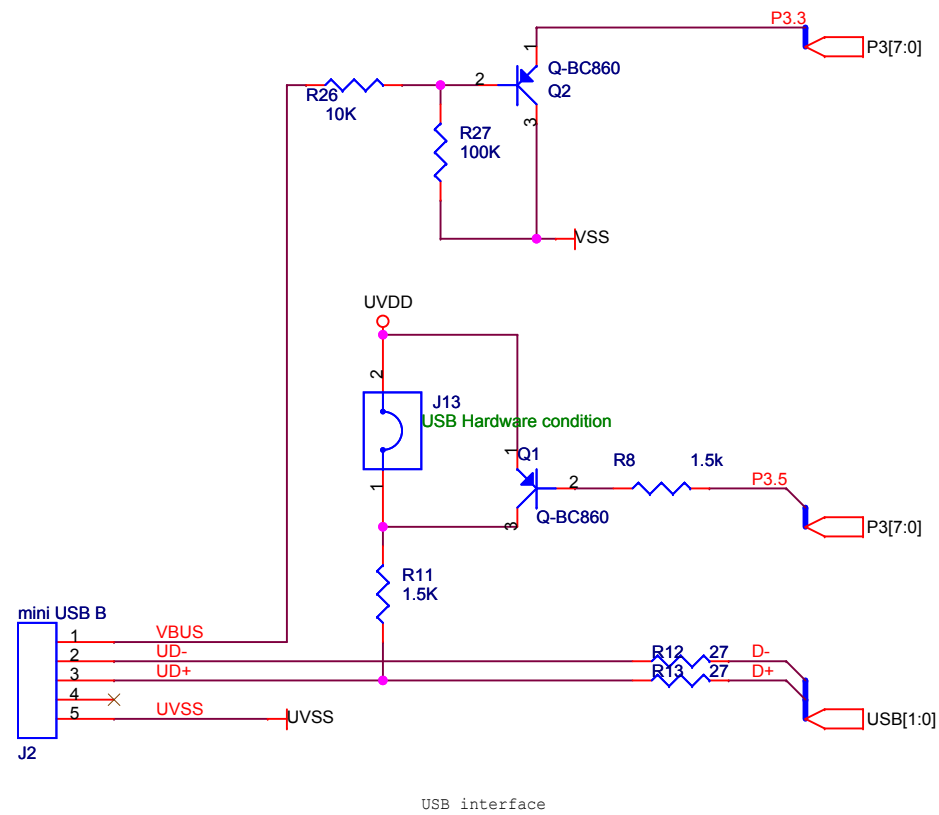
Warning:

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).

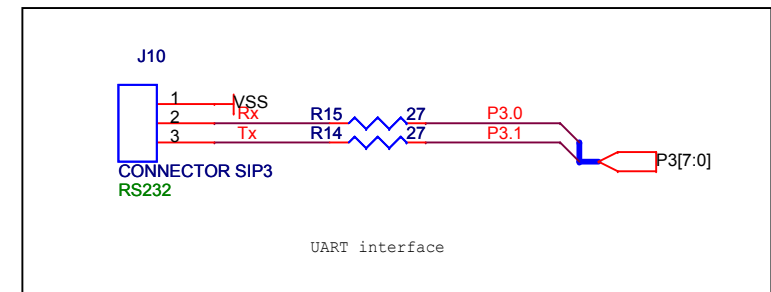
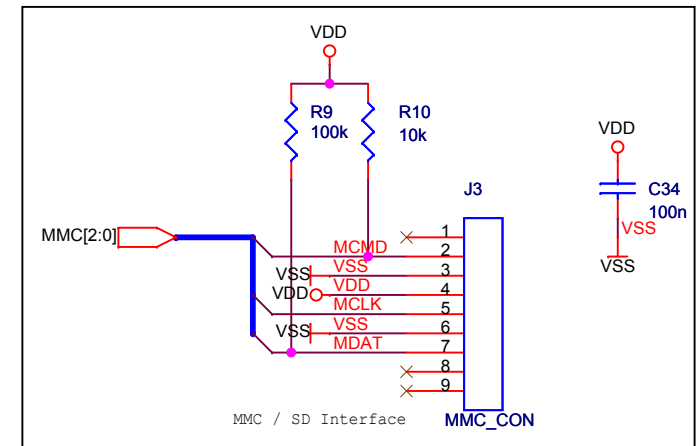
Title		
Power supply		
Size	Document Number	Rev
A	AT83SND2MP3 - Reference board	3.1
Date:	Friday, May 27, 2005	Sheet 2 of 6



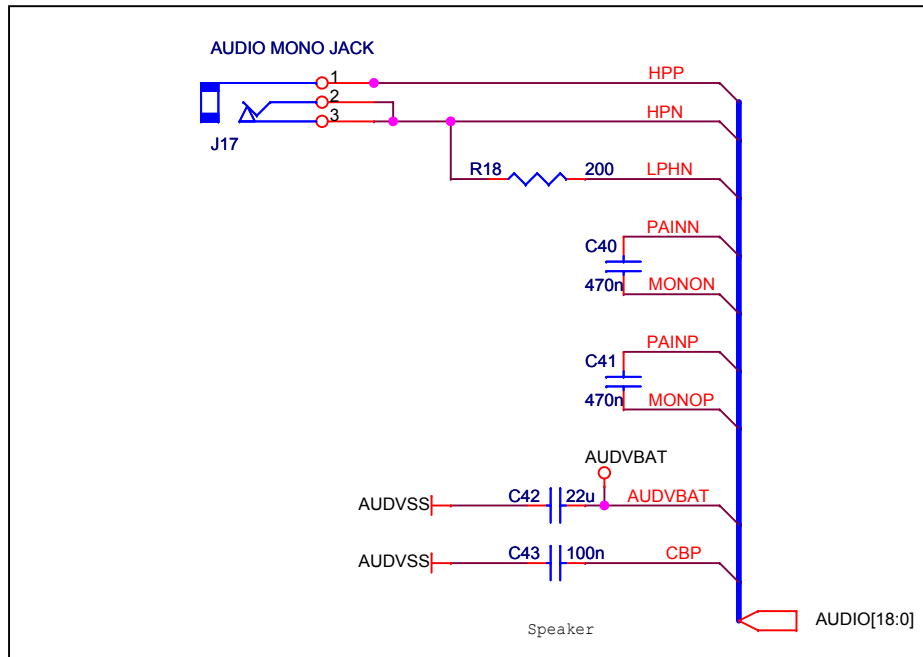
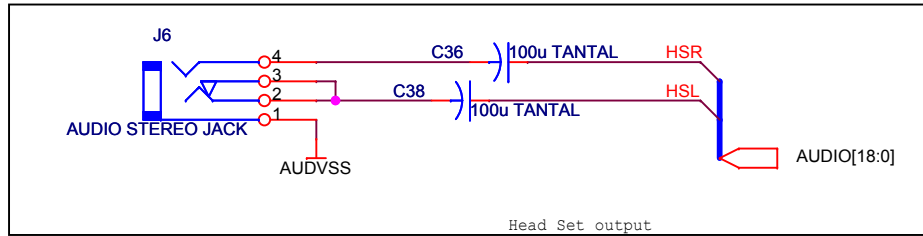
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Clock & Reset		
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A	AT83SND2MP3 - Reference board	3.1
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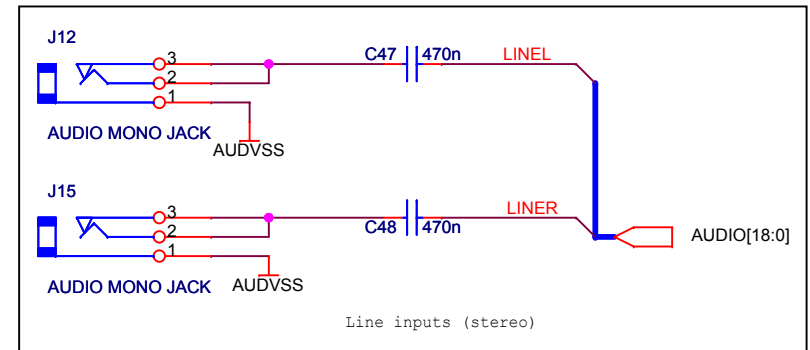
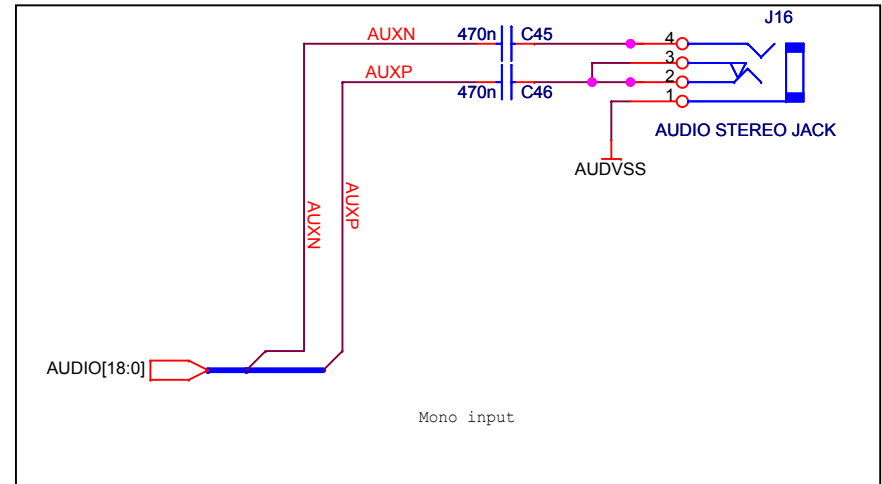
During USB operation, AT8xC51SND2C voltage supply shall be 3.0 V to 3.6V to comply USB specification.



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Standard Interfaces		
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AUDIO OUPUTS



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Audio Interfaces		
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