

How to Create an MP3 Portable Player Using a CoolRunner CPLD



CoolRunner CPLDs are used as the main controller for an MP3 player. This design is available for download from the Web.

by Anita Schreiber, CPLD Applications Engineer
Xilinx, anita.schreiber@xilinx.com

Portable MP3 players are the latest trend in music-listening technology; they require no moving parts, and can be built with very few components. And, because these devices are battery operated, they require low power technologies. That's why the new CoolRunner CPLD family from Xilinx is ideal for this application; this family offers advanced 3V and 5V devices with extremely low power dissipation.

Block Diagram

The block diagram of the CoolRunner MP3 Portable Player is shown in Figure 1. The shaded area shows the logic that is contained in the

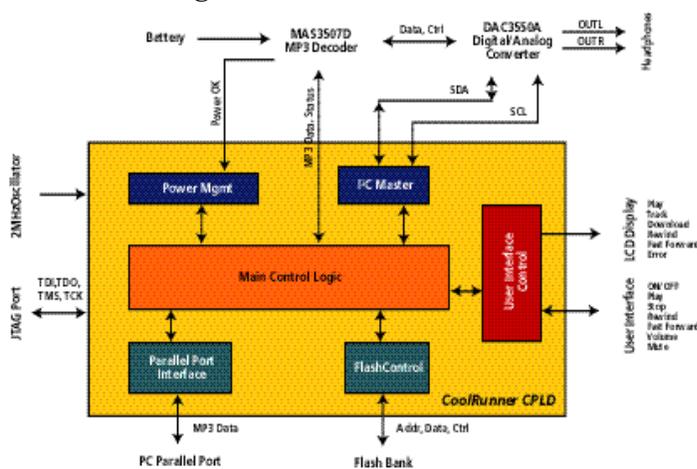


Figure 1 - MP3 portable player block diagram.

CoolRunner CPLD. All other blocks are external devices that can be obtained commercially.

CoolRunner CPLD Logic Modules

The CoolRunner CPLD implements the following functions:

- **The Main Control Logic** provides the intelligence of the CPLD logic and controls all of the various functions.
- **The Parallel Port Interface** is used to downloading MP3 data files to the MP3 portable player.
- **The Flash Control** logic directs the Song Flash memory during MP3 data storage and retrieval. It also controls the Starting Address Flash memory which stores the beginning address of each song in the Song Flash memory.
- **The I²C Master** logic block controls the DAC3550A Digital-to-Analog converter.
- **The User Interface Control** logic receives the user input and updates the LCD display.
- **The Power Management** logic monitors the power level reported

User Interface Button	Function
Play	Pressing this button allows the user to continuously play MP3 songs. When the last song has been played, the MP3 player begins playing the first song again.
Rewind	Pressing this button allows the user to skip to the beginning of the previous song.
Fast Forward	Pressing this button allows the user to skip to the beginning of the next song.
Stop	Pressing this button will halt playing of MP3 songs and resets the player to the beginning of the current song.
Volume/Mute	The volume can be increased and decreased as desired. The player can also be muted.

Table 1 - User interface functions.

from the internal DC/DC converter in the MAS3507D and insures the MP3 Portable Player shuts down properly when the battery voltage drops or the user wishes to turn the player off.

External Devices

The MAS3507D MP3 Decoder chip and the DAC3550A Stereo Audio DAC are both available from Micronas Intermetall and provide a complementary chip set for MPEG decoding and playback. The MAS3507D contains an embedded DC/DC converter which is used to supply the power to the entire player.

The Flash memory bank is composed of 32Mbytes of Flash memory for the storage of MP3 data files and 2Mbytes of Flash memory for the storage of the starting addresses of each song in the Song Flash memory. This design assumes that an LCD display could be designed with unique icons for the various MP3 user interface functions.

User Interface Functions and Operations

The design of this MP3 portable player assumes that a software package is designed that allows users to “rip” CDs and download a collection of their favorite MP3 files to this portable player. The user operations for listening to MP3 songs are shown in Table 1.

Conclusion

CoolRunner CPLDs provide the ideal programmable logic solution for any battery-operated or portable design. This design shows just one example of how a CoolRunner CPLD can be used in these types of applications to provide you with the many benefits of programmable logic while meeting the stringent power requirements of this market. 

For more information, the following can be obtained from the Xilinx@Work section of the Xilinx website (<http://xilinx.com/products/xaw/index.htm>):

- Detailed Application Note (XAPP328)
 - VHDL Source Code
 - VHDL Testbenches