

Portable 16 bit stereo Digital Audio System for Portable Midi.

This system uses a Zilog Z8 80 pin microcontroller as the heart of a portable battery powered MIDI player. The MIDI files (and optional waveform files) are stored on a Compact Flash card, and are played through two 16 bit 44100Ksps parallel input DAC's.



Volume and song advance are to be controlled using a quadrature encoder, like those used in older Sony/Qualcomm cell phones.
Top of Board

Power supply is based on a Maxim Low Dropout Voltage regulator which regulates the 3.6v single-cell Lithium Ion battery to 3.3 volts which runs all the rest of the system.

The power switch is integrated with the headphone jack so the system turns on when you insert the headphones. Analog Devices dual 3 volt 250ma source/sink rail to rail op amp is used to drive the headphones.

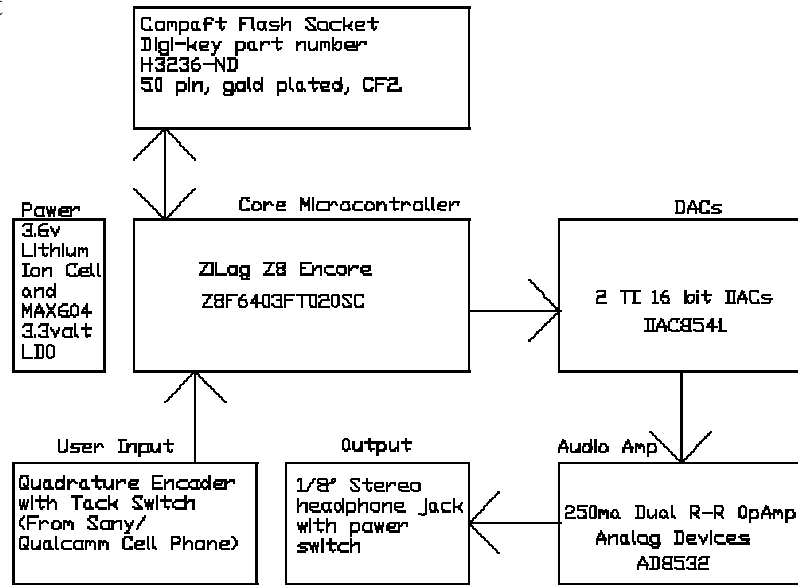
Hardware Block Diagram(See included schematic.pdf for full schematic.)

The hardware is completed and working. (Software is neither completed nor working, but does create triangle waves on the output..) The core of the system is the Zilog Z8 Encore! Z8F6403FT020SC which is the 80 pin package, and is mounted on the bottom side of the board.



Data is to be read off of the CF (Compact Flash) card which is plugged into the gold plated 50 pin CF Socket. This socket is interfaced to the microcontroller with 8 data lines, 3 address lines, and 7 other connections like Output Enable, Chip Select, etc.

Two TI parallel input 16 bit Digital to Analog converter chips are wired up to the microcontroller with 16 data lines each, total 32 data lines on the CPU. The TI DAC8541 has a nearly rail-to-rail output, and can be set to output 1/2 power supply voltage with an input number of 0x0. (It supports both USB and BTC where BTC means Binary Twos Complement, and USB means Unipolar Straight Binary). Since the default signed INT type in



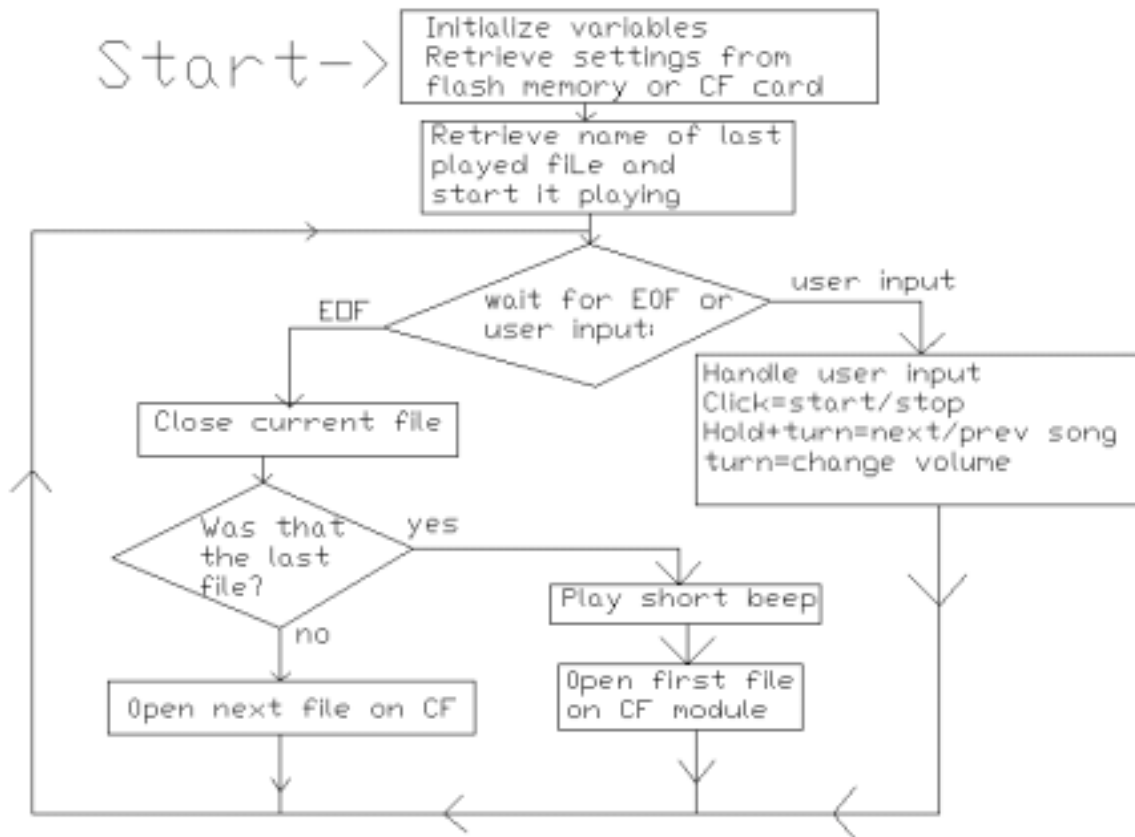
the C compiler for the Zilog Z8 is the same as BTC, one can simply copy the INT type variables directly to the output registers and use numbers from -32000 to +32000 for the DAC, which idles at midway v-out. The "Data Latch" line is a single output on the microcontroller, which feeds both latch inputs of the DAC chips. This allows the loading of the DAC chips with very few instructions. Since both DAC chips are connected to the same "Load" signal, they are latched at the same time, preventing sampling phase errors due to staggered data loading. Note that the DAC chips do support a double-buffering scheme which would allow them to both be "loaded" at the exact same time while sharing a single 16-bit bus. However, I figured I could save a few instructions by not having to share a 16 bit bus with the two DAC's.

The audio headphone amp uses Analog Device's AD8532 dual rail to rail 250ma sink and source Op Amp. The two amps in it are just run as simple voltage followers which then feed the headphones directly, through a pair of 100uF 6 volt capacitors.

Headphone jack is standard 1/8 inch stereo jack, with built in switch which powers on the system when headphones are plugged in.

User input is facilitated with a small quad encoder which is operated with the users thumb or finger. Pressing in on the encoder closes a momentary switch which is can be used to select menu options and toggle between modes and the like.

The Power Section starts with a 3.6v 900MAH Lithium Ion rechargeable battery (Cell, actually) which feeds Maxim IC's MAX604 3.3 volt, 500ma, low dropout voltage regulator. The power is switched by the headphone jack between the battery and the regulator.



Flowchart for the software which the author intended to write for this device.

Item	Qty	Reference	Part Name	Description
1	1	U4	AD8532-SMT	SMD Dual Op Amp 8 pin 250ma r-r io 3v to 5v
		C3 C5-6 C8-		
2	10	9 C12-16	CAPS-.47U-CER	CAP 0805 CER 0.47U 25V 20%
3	2	C4 C7	CAPS-100U-6V	Cap 100uf 6V SMT salvage
4	2	C10-11	CAPS-22P-CER	CAP 10% NPO CHIP 0805 SMD
5	2	C1-2	CAPS-22U-16V-TANT	Cap Tantalum 22uf 16V SMT 6mm
6	1	J3	CF50SOCKET	50 pin Compact Flash socket with gold plated pins.
7	2	U2 U6	DAC8541	16 bit DAC 250ksp/s parallel input
8	1	S1	ENCODERCELLPHONE	Quadrature encoder with momentary switch (Salvaged)
9	1	J2	JACKSTEREO1/8	Stereo headphone jack with built in power switch (Salvaged)
10	1	U1	MAX604	3.3v LDO 500ma, Maxim part number MAX604
11	1	J1	METRICPLUG	The power plug: Salvaged from old apple floppy drive.
12	3	TP1-3	PAD-35	Hole 35 mils (The test points)
13	1	R7	R603-390	RESISTOR SMT 0603 1% 390
14	1	R8	R603-100K	RESISTOR SMT 0603 1% 100K
15	7	R1-6 R9	R603-10K	RESISTOR SMT 0603 1% 10K
16	1	X1	XTAL20SMT	quartz crystal smt 20MHz
17	1	U5	Z8F6403FT020SC	20Mhz Z8 Encore! Zilog microcontroller.
18	1	J4	ZILOGDBGPLUG	6 pin plug to which the programmer connects.

Bill of materials