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(54) Title: DIGITAL MEDIA PLAYING DEVICE

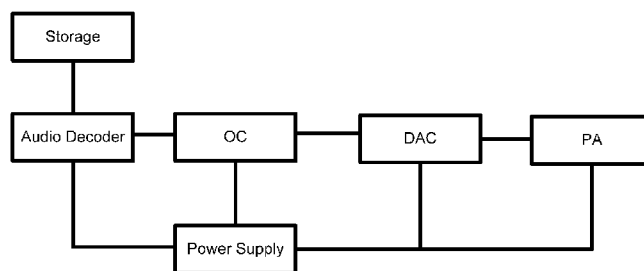


Figure 2

(57) Abstract: It is provided a digital media playing device, comprising a storage for storing a media file; an audio decoder for generating digital signal for audio from the media file; a digital to analog converter for converting digital signal for audio to analog signal and providing the analog signal to a power amplifier; and the power amplifier for amplifying the analog signal; wherein, an optical coupler is added between the audio decoder and the digital to analog converter, and the optical coupler transmits the digital signal for audio from the audio decoder to the digital to analog converter by using light signal.

DIGITAL MEDIA PLAYING DEVICE

TECHNICAL FIELD

The present disclosure relates to a consumer electronics device, and more particularly, relates to a digital media playing device.

BACKGROUND

A mobile digital media player (M-DMP), a portable media player (PMP), or a digital audio player (DAP), is a portable digital consumer electronics device capable of storing and playing digital media such as audio, images, and video files. The data is typically stored on a flash memory, Microdrive (it is a brand name for a miniature, 1-inch hard disk designed to fit in a CompactFlash (CF) Type II slot. The release of similar drives by other makers has led to them often being referred to as 'microdrives'), or a hard drive (or a hard disk drive). In contrast, analog portable audio players play music from non-digital media such as cassette tapes, or records.

Often mobile digital audio players are marketed and sold as "portable MP3 players", even if they also support other file formats and media types. Other types of electronic devices which can also act like mobile digital media players, but only have those media playback features as a secondary function, are cellphones (or smart phones), personal computers, set top boxes (STB), internet tablets, and sometimes even digital cameras are referred as portable media players because of their playback capabilities.

SUMMARY

According to an aspect of the present invention, it is provided a digital media playing device, comprising a storage for storing a media file; an audio decoder for generating digital signal for audio from the media file; a digital to analog converter for converting digital signal for audio to analog signal and providing the analog signal to a power amplifier; and the power amplifier for

amplifying the analog signal; wherein, an optical coupler is added between the audio decoder and the digital to analog converter, and the optical coupler transmits the digital signal for audio from the audio decoder to the digital to analog converter by using light signal.

- 5 It is to be understood that more aspects and advantages of the invention will be found in the following detailed description of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

- 10 The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, will be used to illustrate an embodiment of the invention, as explained by the description. The invention is not limited to the embodiment.

In the drawings:

- 15 Fig. 1 is a block diagram showing a part of an architecture of a typical audio player according to prior art;

Fig. 2 is a block diagram showing an architecture of a high quality digital audio player according to a 1st embodiment of the present invention;

Fig. 3 is a block diagram showing an architecture of a high quality digital audio player according to a 2nd embodiment of the present invention;

- 20 Fig. 4 is a block diagram showing an architecture of a high quality digital audio player according to a 3rd embodiment of the present invention; and

Fig. 5 is a block diagram showing an architecture of a high quality digital audio player according to a 4rd embodiment of the present invention.

DETAILED DESCRIPTION

25 The embodiment of the present invention will now be described in detail in conjunction with the drawings. In the following description, some detailed descriptions of known functions and configurations may be omitted for clarity and conciseness.

Fig. 1 is a block diagram showing a part of an architecture of a typical audio player according to prior art. The audio player comprises components of a storage, an audio decoder, a digital to analog converter (DAC), a power amplifier (PA) and a power supply. All these components are connected electrically. In other words, the connections between all components are electric connections.

---The storage stores audio files in at least following audio formats comprising MP3 (MPEG-1 or MPEG-2 audio layer III), Windows Media Audio (WMA), Advanced Audio Coding (AAC), Waveform Audio File Format (WAV), Ogg Vorbis and Free Lossless Audio Codec (FLAC). The storage can be implemented by a flash memory, Microdrive, a hard disk drive etc. Further, it should note that the storage can be CompactFlash (CF), Secure Digital (SD) and Memory Sticks that are inserted into memory card slots of the audio player.

---The audio decoder reads an audio file from the storage and decodes the audio file so as to generate digital audio signal and transmits the digital audio signal to DAC. The audio decoder can be implemented by either a dedicated integrated circuit or a common processor together with a computer program implementing one or more algorithms that decompress digital audio data according to one or more given audio formats.

---The DAC converts the digital audio signal to analog audio signal and provides the analog audio signal to the PA. The DAC can be implemented with an integrated circuit (IC).

---The PA is an electronic amplifier that amplifies the analog audio signal. And the amplified analog audio signal drives loudspeakers or earphones (not shown in the Fig. 1).

---The power supply supplies electric power to all components of the audio player. The power supply can be a disposable battery, a rechargeable battery or AC (alternating current) adapter connecting to the AC power supply.

However, a digital circuit of audio decoder and other components of the audio player as shown in the prior art generates noises, and the electromagnetic

interference (EMI, or called radio frequency interference RFI) of the digital circuit affects an analog audio circuit, which consequently reduces analog audio quality.

Fig. 2 is a block diagram showing an architecture of a high quality digital audio player according to a 1st embodiment of the present invention. In the
5 embodiment, we propose an audio player without an electric connection between analog audio circuits and audio decoder. In this way, EMI impact on analog audio circuits is reduced.

As shown in Fig. 2, an optical coupler (OC, also called opto-isolator, optocoupler or optical isolator) is introduced to remove an electric connection
10 between the audio decoder and the DAC. An OC is a component that transfers electrical signals between two isolated circuits by using light. A common type of OC consists of a light emitter and a photosensor in the same opaque package. The light emitter converts electrical input signal into light signal, and the photosensor detects incoming light and generates electrical signal. Other types
15 of source-sensor combinations include LED-photodiode, LED-LASCR, and lamp-photoresistor pairs. Usually opto-isolators transfer digital (on-off) signals, but some techniques allow them to be used with analog signals.

In the embodiment, the power of OC is supplied by the power supply. The light emitter, which is connected to the audio decoder, receives digital audio
20 signal (which is electrical signal) from the audio decoder, converts the digital audio signal in electrical form into light signal, and transmits the light signal in a closed optical channel (also called dielectrical channel). The photosensor, which is connected to the DAC, detects the incoming light signal, generates the electronical signal and transmits the electronical signal to the DAC.

25 However, the embodiment as shown in the Fig. 2 cannot insulate all electric connections between digital circuits and analog audio circuits. In order to get much better effects, all electric connections between digital circuits and analog audio circuits are removed by adding a separate power supply. Fig. 3 is a block diagram showing an architecture of a high quality digital audio player according
30 to a 2nd embodiment of the present invention. In this embodiment, a 2nd power

supply is added to supply power to a digital circuit, i.e. audio decoder, and the 1st power supply supplies power to analog circuits, i.e. OC, DAC and PA. Herein, the 1st power supply is electrically connected to a main power or is a disposable battery, and 2nd power supply is a disposable battery.

5 Fig. 4 is a block diagram showing an architecture of a high quality digital audio player according to a 3rd embodiment of the present invention. In the embodiment, both the 1st power supply and 2nd power supply are rechargeable batteries. When it is detected that one of the 1st power supply and 2nd power supply is of low power, a switch, which is electrically connected to a main power,
10 is operated to supply power of the main power to the power supply of low power.

According to a variant, the 1st power supply is a rechargeable battery and the 2nd power supply is an AC adapter connecting to an AC power supply. If detecting the power level of the 1st power supply is low, the 2nd power supply is also operated to (e.g. by a switch) charge the 1st power supply in addition to
15 supply of power to the audio decoder.

Fig. 5 is a block diagram showing an architecture of a high quality digital audio player according to a 4th embodiment of the present invention. In the embodiment, an electromagnetic shield is applied to cover the analog circuit, the 1st power supply, and the switch so as to screen EMI impact as much as
20 possible. Besides, according to a variant, the electromagnetic shield is applied to the analog circuit only as in the figures 2 and 3.

Although above embodiments are described in connection with a digital audio player, a person skilled in the art shall understand that the solution can also apply to an audio part of a video player, e.g. mp4 player, tablet, etc.

25 A number of implementations have been described. Nevertheless, it will be understood that various modifications may be made. For example, elements of different implementations may be combined, supplemented, modified, or removed to produce other implementations. Additionally, one of ordinary skill will understand that other structures and processes may be substituted for those
30 disclosed and the resulting implementations will perform at least substantially

the same function(s), in at least substantially the same way(s), to achieve at least substantially the same result(s) as the implementations disclosed.

CLAIMS

1. A digital media playing device, comprising
a storage for storing a media file;
5 an audio decoder for generating digital signal for audio from the media file;
a digital to analog converter for converting digital signal for audio to analog
signal and providing the analog signal to a power amplifier; and
the power amplifier for amplifying the analog signal;
wherein, an optical coupler is added between the audio decoder and the
10 digital to analog converter, and the optical coupler transmits the digital signal for
audio from the audio decoder to the digital to analog converter by using light signal.
2. The digital media playing device of the claim 1, further comprising
a first power supply for supplying power to the optical coupler, digital to
15 analog converter and the power amplifier; and
a second power supply for supplying power to the audio decoder.
3. The digital media playing device of the claim 2, wherein the 1st power supply is a
disposable battery and the 2nd power supply is a disposable battery.
20
4. The digital media playing device of the claim 2, wherein the 1st power supply is a
rechargeable battery and the 2nd power supply is a disposable battery.
5. The digital media playing device of the claim 4, further comprising a switch
25 connecting the 1st power supply and the 2nd power supply, the switch is used for,
when it is detected the 1st power supply is of low power, switching to supply power
of the 2nd power supply to the 1st power supply of low power.

6. The digital media playing device of the claim 1 to 5, further comprising an electromagnetic shield being applied to the digital to analog converter and the power amplifier.
- 5 7. The digital media playing device of any one of claims 1 to 5, further comprising an electromagnetic shield being applied to the optical coupler, the digital to analog converter, the power amplifier, the 1st power supply and the switch.

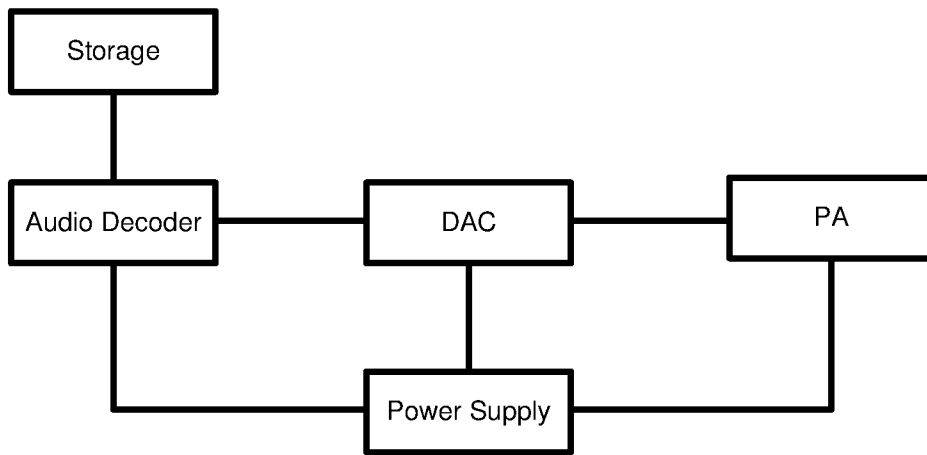


Figure 1 (Prior Art)

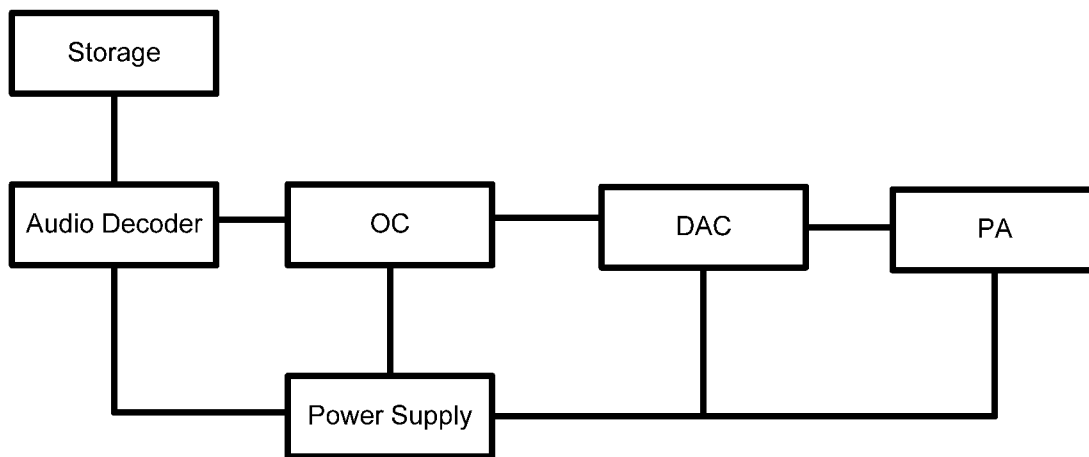


Figure 2

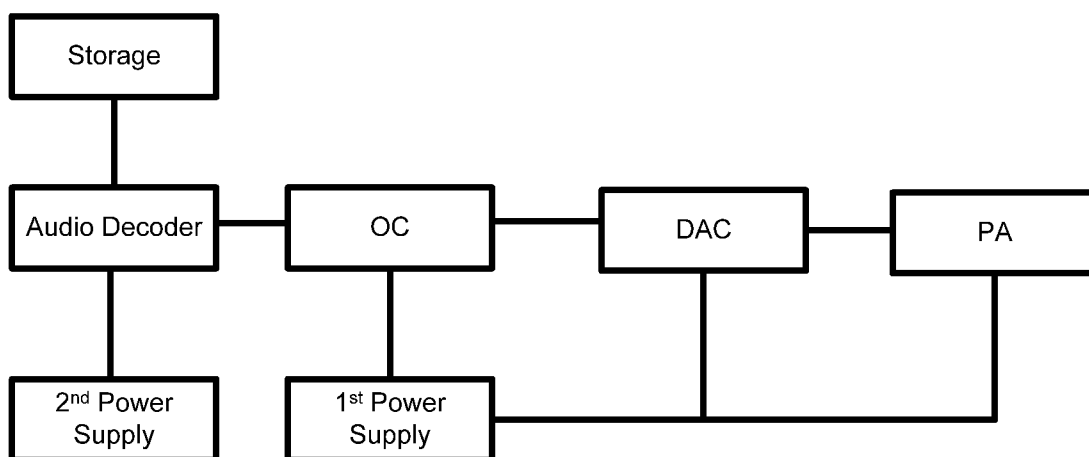


Figure 3

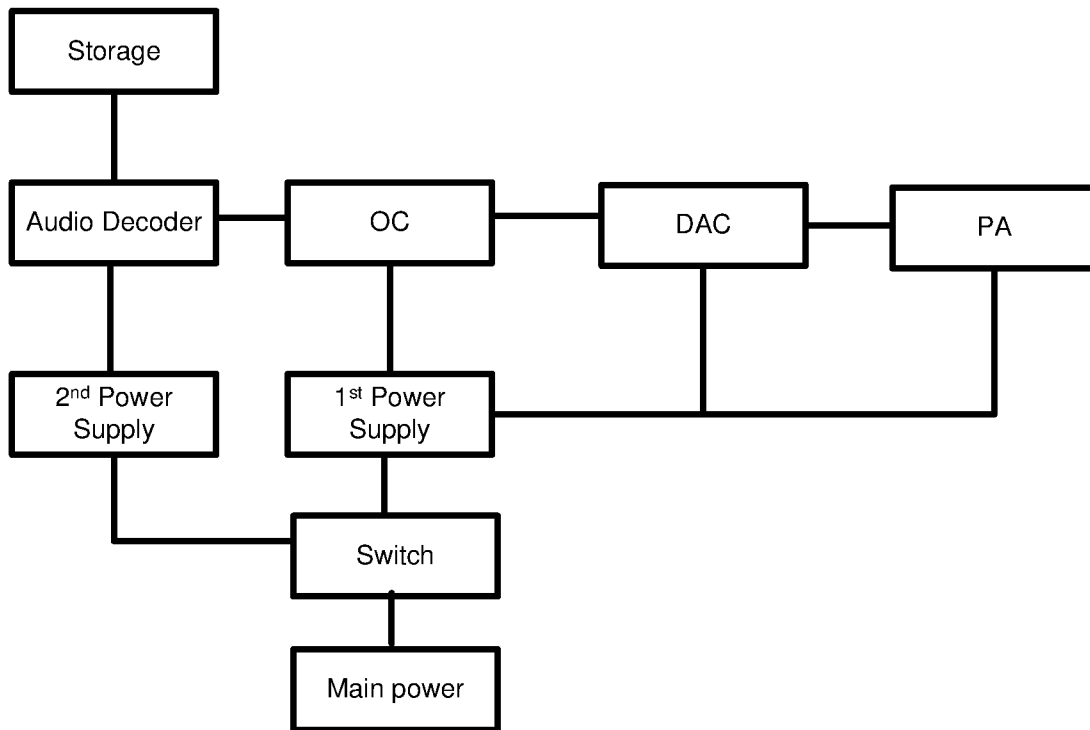


Figure 4

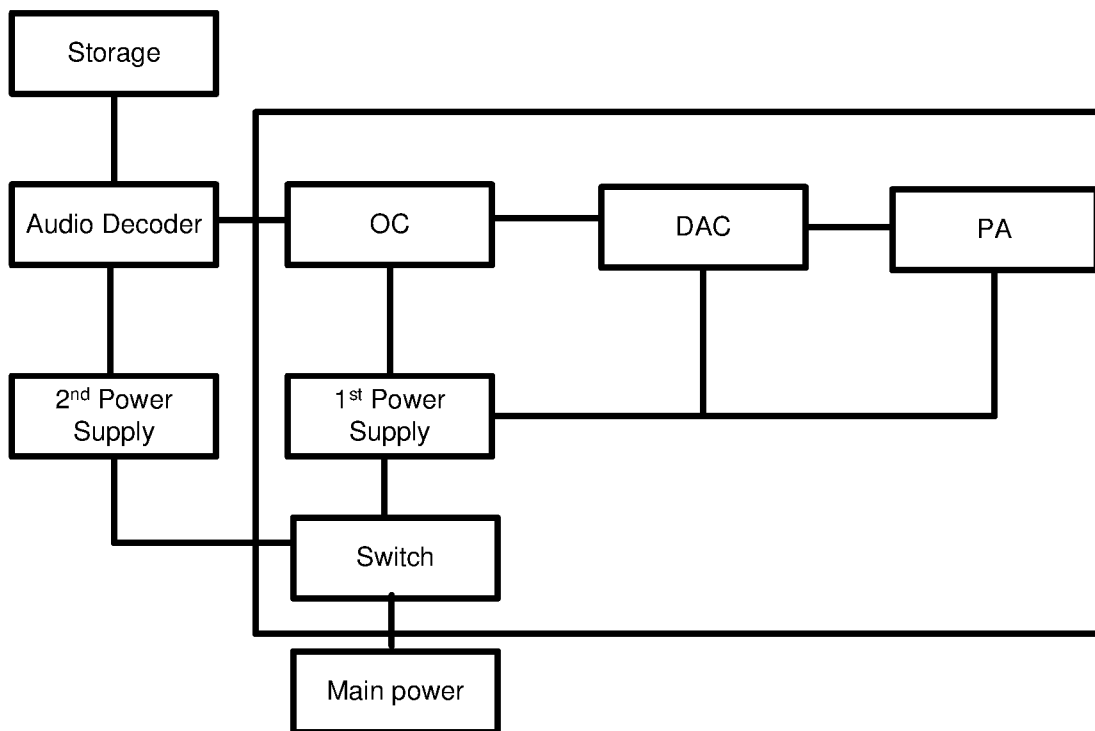


Figure 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/081126

A. CLASSIFICATION OF SUBJECT MATTER

G11C 7/16 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G11C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT, CNKI, EPODOC, WPI, IEEE: media, audio, video, play, digital, analog, convert, optical, coupler, isolator, separator, light, signal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 201655328 U (SHANGHAI SECOND POLYTECHNIC UNIVERSITY) 24 November 2010 (2010-11-24) paragraphs [0013], [0020]	1-7
Y	CN 101582276 A (DUAN, RUI) 18 November 2009 (2009-11-18) page 3, lines 1-6	1-7
Y	US 2007030661 A1 (MORRIS, THOMAS SCOTT ET AL.) 08 February 2007 (2007-02-08) paragraph [0005]	6, 7
A	CN 101393766 A (MEDIATEK INC.) 25 March 2009 (2009-03-25) the whole document	1-7
A	US 6376851 B1 (WORLEY, EUGENE ROBERT) 23 April 2002 (2002-04-23) the whole document	1-7



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

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				US	2012217048	A1	30 August 2012
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