FREEDSP-AURORA
SPECIFICATIONS
PRELIMINARY

REVISION HISTORY

Revision	Description	Date
v1.0	Initial Version	15 Jan 2019

ABOUT FREEDSP-AURORA

The freeDSP-aurora is a cost-effective real-time audio signal processing solution for researchers and the do-it-yourself community. It is a bare circuit board that can be incorporated into your own projects. It comes with no housing. Easy assembling and simple programmability are the main focus. It is based on Analog Devices' ADAU1452 DSP chip in bundle with the free graphical development environment SigmaStudio. The programming model is function-block based – comparable to other graphical programming languages like PureData or Max/MSP. Many prebuilt blocks (e.g., filters, compressors, effects, or logic) can be placed in the signal path via drag and drop. If the included libraries do not have the functions needed, low-level blocks, such as multipliers and delays, can be wired together to create custom algorithms. For more information please refer to the Analog Devices website.

FreeDSP-aurora offers a wide range of DSP processing options and interface controls with easy programmability. It can be used in various audio applications, e.g.:

Room compensation / system equalization

Digital crossovers in active loudspeaker concepts

Multiband dynamics processing

Delay compensation / phase shift

Bass enhancement

Subwoofer integration

Advanced instrument audio effect units

Stereo image widening

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A XMOS XE216-512-TQ128 MCU is used to expose an USB Audio Class 2 compliant interface to a host computer running macOS, Linux or Windows 10. The boards provides 8 audio input and 8 audio output channels to the host computer. Additionally an ADAT input/output and a Wordclock input/output is provided by the XMOS MCU.

The ESP32 MCU controls the operation of the DSP. Furthermore, it provides WiFi and Bluetooth connectivity and handles peripherals like rotary encoder, display, temperature sensor, PWM controlled fan and IR sensor.

As part of the project an open source software is published that controls the operation of the freeDSP-aurora from macOS, Windows or iOS. Via the control software the user can access all parameters of the uploaded DSP schematic. Due to the open source licenses users can modify the control software for supporting their own DSP schematics.

The plans and software for the freeDSP-aurora board are published under a Creative Commons Attribution NonCommercial ShareAlike 4.0 International (CC BY-NC-SA 4.0) license, which allows the unrestricted use and modification of the module for non-commercial purposes. This means that experienced users can make their own version of the board, extending it and improving it, as long as they credit freeDSP and auverdion and release their designs under the same license.
The freeDSP brand and freeDSP logo are copyright of Sebastian Merchel and Ludwig Kormann and cannot be used without formal permission.
The auverdion brand is copyright of Raphael Knoop and cannot be used without formal permission.
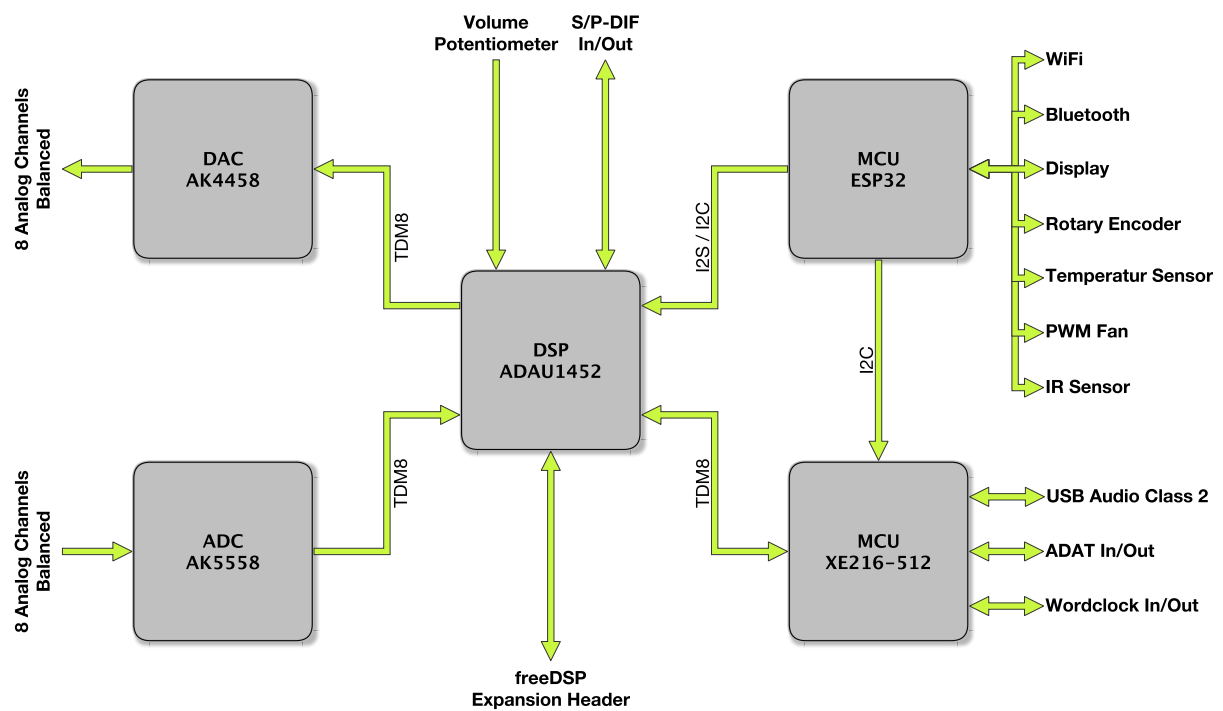This getting started guide is published under the same CC license.

FEATURES

- Analog Devices ADAU1452, 294.912 MHz, 32-bit SigmaDSP

    6144 SIMD instructions per sample @ 48kHz fs

    40kWords of data RAM

    800ms digital audio delay pool @ 48kHz fs

    8 stereo ASRCs with 139dB DNR

- XMOS XE216-512-TQ128 for multichannel bidirectional audio streaming
- ESP32 for WiFi or Bluetooth control
- AKM AK4458 32bit-DAC
- AKM AK5558 32bit-ADC
- Supporting sample rates between 44.1kHz and 192kHz
- 8 analog balanced input channels, +6dBu
- 8 analog balanced output channels, +6dBu
- S/P-DIF input and output
- ADAT input and output
- Wordclock input and output
- Support for display, rotary encoder, volume potentiometer, temperature sensor, PWM controlled fan, IR sensor
- One freeDSP expansion header
- USB Audio Class 2 Bidirectional streaming with 8 channels in and 8 channels out, full-duplex. Works with ASIO driver under Windows 10 and driverless under macOS and Linux.
- Realtime control software for Windows, macOS, Linux, iOS connecting by WiFi or Bluetooth available under an open source license
- Board dimensions: 100mm x 100mm

OVERVIEWS

BLOCK DIAGRAM

CONNECTORS

volume potentiometer

USBi

freeDSP expansion

IR remote

Rotary Encoder

PWM fan

temperature sensor

ADAT

S/P-DIF

Wordclock

8 channel analog output pin header

8 channel analog input pin header

+12V power supply

USB Audio 2