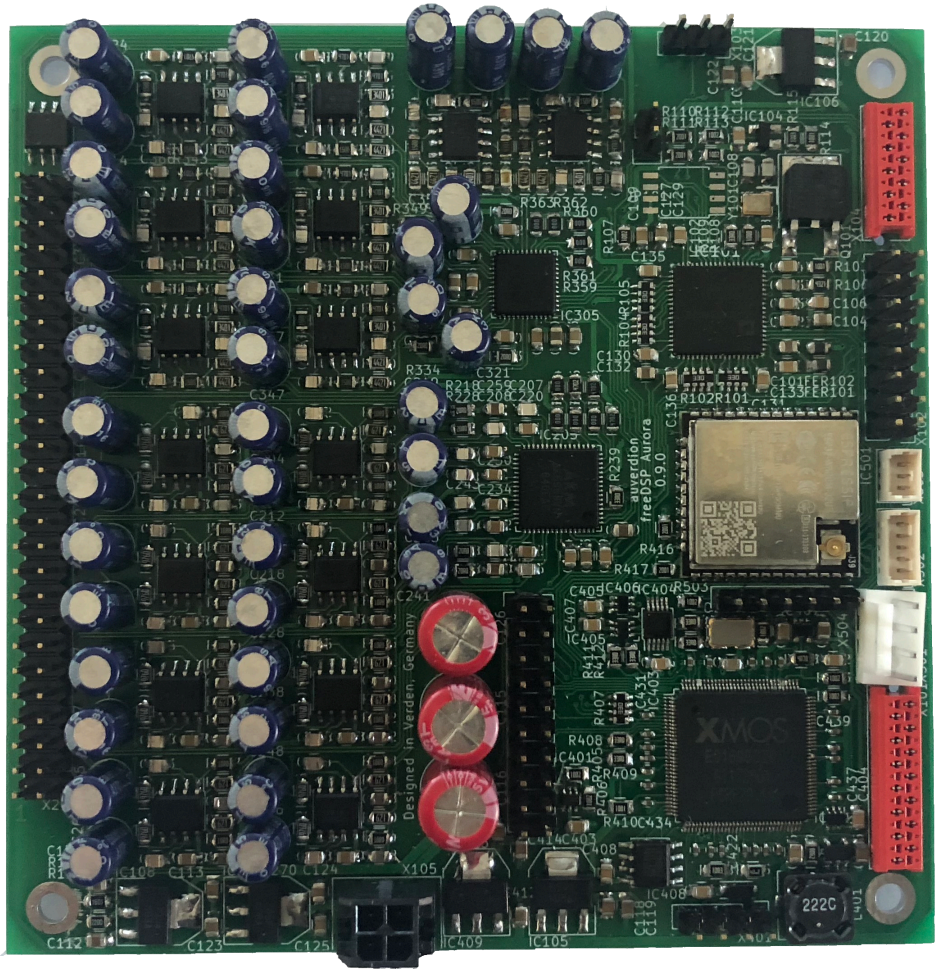


GETTING STARTED WITH FREEDSP-AURORA

PRELIMINARY

REVISION HISTORY

Revision	Description	Date
v1.0	Initial Version	28 Nov 2018

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
…

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.

IMPORTANT INFORMATION

The freeDSP-aurora board might generate signals that may damage your audio equipment. Please read and understand this manual before starting to work with your board. Adjust all hardware settings and configure your software before connecting any audio equipment to freeDSP-aurora. Always start with low volume on your amplifier and slowly increase the level to reduce the risk of damaging your audio system.

freeDSP-aurora is provided to you ‘as is’. We make no express or implied warranties whatsoever with respect to its functionality, operability, or use, including, without limitation, any implied warranties of merchantability, fitness for a particular purpose, or infringement. We expressly disclaim any liability whatsoever for any direct, indirect, consequential, incidental or special damages, including, without limitation, lost revenues, lost profits, losses resulting from business interruption or loss of data regardless of the form of action or legal theory under which the liability may be asserted, even if advised of the possibility or likelihood of such damages. Features and specifications might change without prior notice.

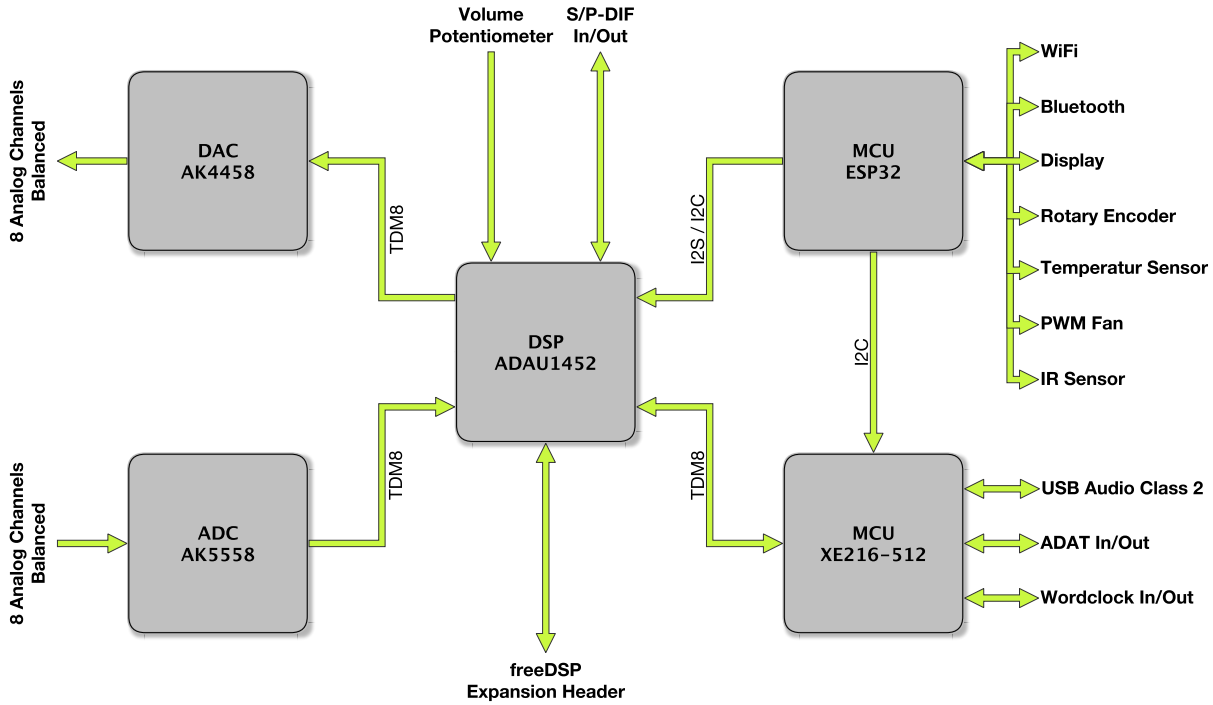
Please keep in mind that freeDSP-aurora is an open-source spare-time project. Because freeDSP-aurora is very flexible, many applications are possible. Questions and new ideas can be discussed online with other DIYers. Please use the *Digital Line Level* subforum @ diyAudio.com or the *Elektronik* subforum @ www.diy-hifi-forum.eu to connect with other people working with freeDSP-aurora. Please create individual threads for your topics only if you cannot find your issue in the existing threads. Some questions can be answered by carefully reading this manual. We cannot provide individual support via email. Thank you for your understanding!

FEATURES

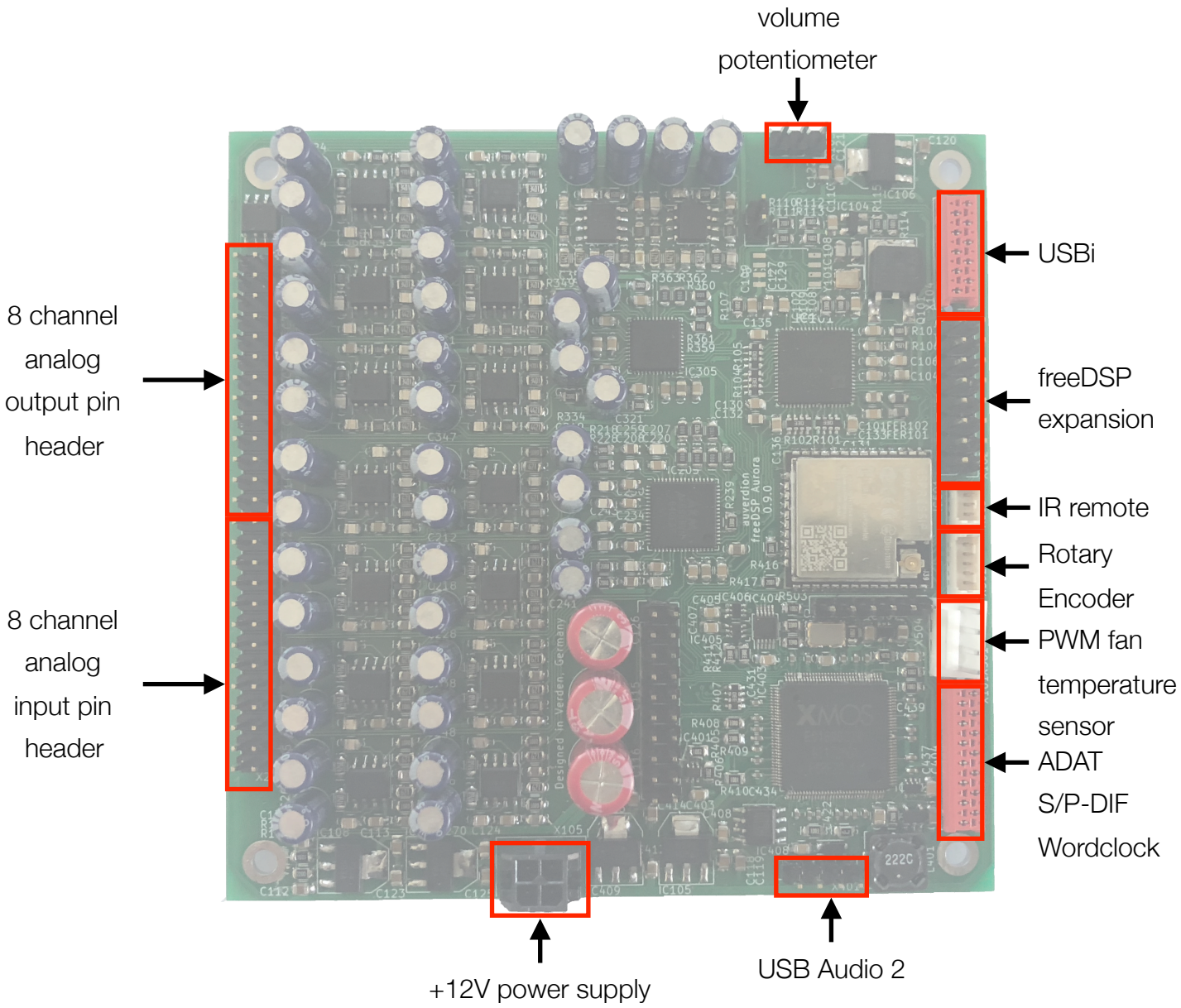
- Analog Devices ADAU1452 DSP
- XMOS XE216-512-TQ128 for multichannel bidirectional audio streaming
- ESP32 for WiFi or Bluetooth control
- AKM AK4458 32bit-DAC
- AKM AK5558 32bit-ADC
- Supporting sample rates between 44.1kHz and 192kHz
- 8 analog balanced input channels, +6dBu
- 8 analog balanced output 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

Analog Audio Connections

Analog audio input connections can be made on pin header X201. The audio inputs are designed for balanced operation at +6dBu maximum input level. Unbalanced sources can be connected as well by grounding the negative input. In the latter case you may have change the gain of the input stage to improve the signal to noise ratio. Alternatively you may want to use a conversion circuit if your audio sources use a different connection (e.g unbalanced) or have another level.

Analog audio output connections can be made on pin header X301. The audio outputs are designed for balanced operation at +6dBu maximum output level. In case of unbalanced sinks leave the negative output unconnected. In the latter case you may have to change the gain of the output stage to improve the signal to noise ratio. Alternatively you want to use a conversion circuit if your audio sinks use a different connection (e.g. unbalanced) or have another level.

When making audio connections, make sure that your equipment is powered off to avoid damage.

TODO: Give resistor values for gain changes

Digital Audio Connections

On connector X101 you can make your digital audio connections like S/P-DIF input and output and ADAT input and output. Wordclock input and output can be connected to X101, too.

FreeDSP Expansion Header

X102 is the an expansion header for additional input and output boards. The pinout complies with the I2S expansion header specification of the freeDSP project. If you want to connect a I2C display please connect it to this header, too.

Fan and Temperature Sensor

On connector X501 you can connect a PWM controlled fan. Please use the Sense pin to connect a temperature sensor (e.g. NTC).

Rotary Encoder

On connector X502 you can connect a rotary encoder with or without a push button.

IR Sensor

On connector X503 you can connect an infra red receiving diode.

USB Connection

Your host computer connects on the pin header X401. Please use a common off-the-shelf cable assemblies (typically used in computer hardware). Always confirm the pin-out with the manufacturer, or you could easily cause damage to your computer or freeDSP-aurora. Usually the GND-pins 4 and 5 can be identified by a black wire, but you can never be sure unless you checked the manufacturer's specifications of the connector.

FreeDSP-aurora was designed to be class compliant with UAC2. Thus, on macOS and Linux you don't need to install any driver. Windows 10 comes now with a UAC2 driver as well but you may have to install additional stuff like the free software asio4all and your audio software needs to support ASIO. Please note, that ASIO is only needed if you want to use the 8 input channels for recording audio. If you just want to use freeDSP-aurora to stream audio data to your audio equipment, ASIO is not needed and you can skip the asio4all installation.

Power Supply

freeDSP-aurora needs a power supply of +12V on X105. Attention: Apply power to the board only after all connections have been made and you double-checked everything.

OPTIONAL INPUT AND OUTPUT ADD-ONS

FreeDSP-aurora was designed to support as many applications as possible. Therefore, all inputs and outputs are on pin headers or ribbon cable connectors. This way user can adapt the front-ends to their needs. Some add-on boards will be available for this project. These boards will cover the most common used input output configurations, e.g. active multi-way loudspeaker or an 8 channel loudspeaker management or buttons and displays for user interaction.
The add-on boards are coming soon.

HOW TO GET FREEDSP-AURORA UP AND RUNNING

The steps in this chapter are only required if you want to build your freeDSP-aurora from scratch or if you want to initially program or update firmwares. If you just want to upload another DSP schematic you can directly jump to chapter **Upload a DSP schematic**.

GET EVERYTHING NEEDED

You will need a soldering iron with a fine tip plus some soldering experience to assemble the surface mounted and through hole components.
Additionally you need:

- an USB2Serial converter like a FTx232 module, e.g. https://www.ftdichip.com/Products/Modules/DevelopmentModules.htm#FT2232H_Mini or similar
- optionally a XTAG debug adapter https://www.xmos.com/support/boards?product=19480 if you want to use the features provided by the XMOS device
- optionally an USBi adapter from Analog Devices (EVAL-ADUSB2EBZ) or the freeUSBi programmer (see the freeDSP website) for programming the DSP if you want to program the DSP through SigmaStudio

Order the freeDSP-aurora kit. Sometimes centralized buying of PCB and all parts is offered on the forums. Please keep in mind that freeDSP-aurora is a spare-time project. It may take some time until a new batch of boards and/or kits is offered.

(a) Alternatively, order the PCB via www.tindie.com. You will also need to order all electronic parts. The components can be ordered via DigiKey (or other distributors). This might be the fastest option.
(b) Alternatively, you can manufacture your own circuit board or modify and extend the original design. This might be the most flexible option, but needs more expertise (and money) to get up and running.
(c) Alternatively, manufacture the printed circuit board and order all parts yourself. You might want to locally organize centralized buying and board production together with some friends. You can find the necessary KiCAD files of the board on the freeDSP website

www.freeDSP.cc. You will also need to order all electronic parts. The components can be ordered via DigiKey (or other distributors).

SOLDER THE BOARD

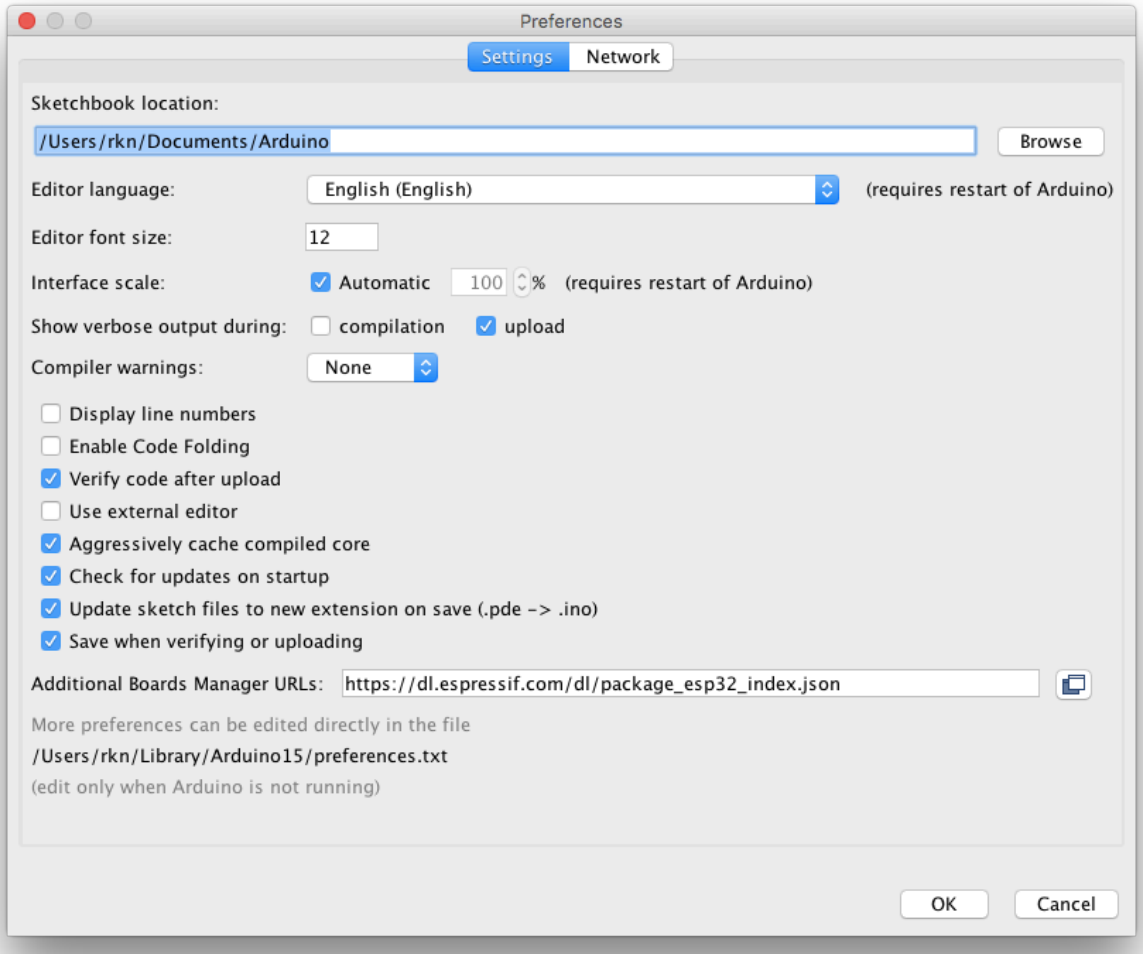
You should start with soldering the most difficult part: The ICs. On youtube you can find tutorials how to solder the QFPs packages, e.g.
https://www.youtube.com/watch?v=YUryJOAiPa4
and how to solder the QFNs packages, e.g.
https://www.youtube.com/watch?v=BvhE16vBfX4
Then continue with all the other SMDs and finally solder the THT components. Always start with the components with lowest height.

PROGRAMMING THE ESP32

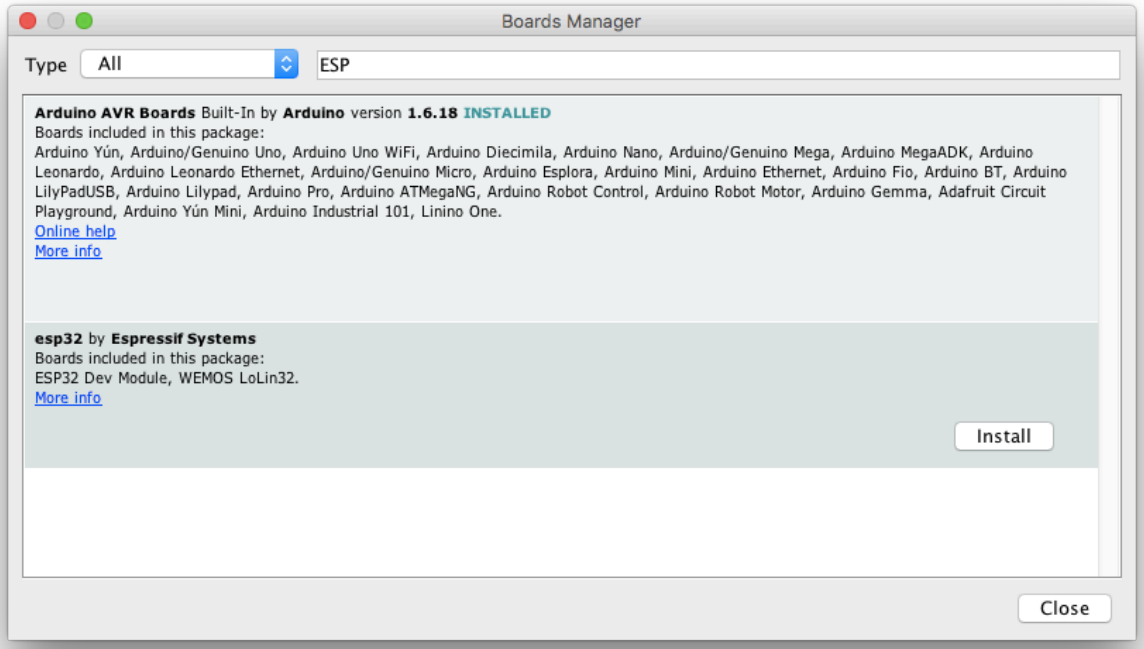
The ESP32 MCU on the board is needed to make parameter changes at runtime, save them and to upload new schematics to the DSP.

To program the ESP32 with the latest freeDSP-aurora firmware you have to do few steps:

1. Download and install the Arduino IDE from https://www.arduino.cc without charge.
2. Start the Arduino IDE and open the Preferences dialog and insert https://dl.espressif.com/dl/package_esp32_index.json for the *Additional Boards Manager URLs* and click *OK.*



3. Go to *Tools->Board->Boards Manager* and search for ESP, select the esp32 package and click on *Install*.



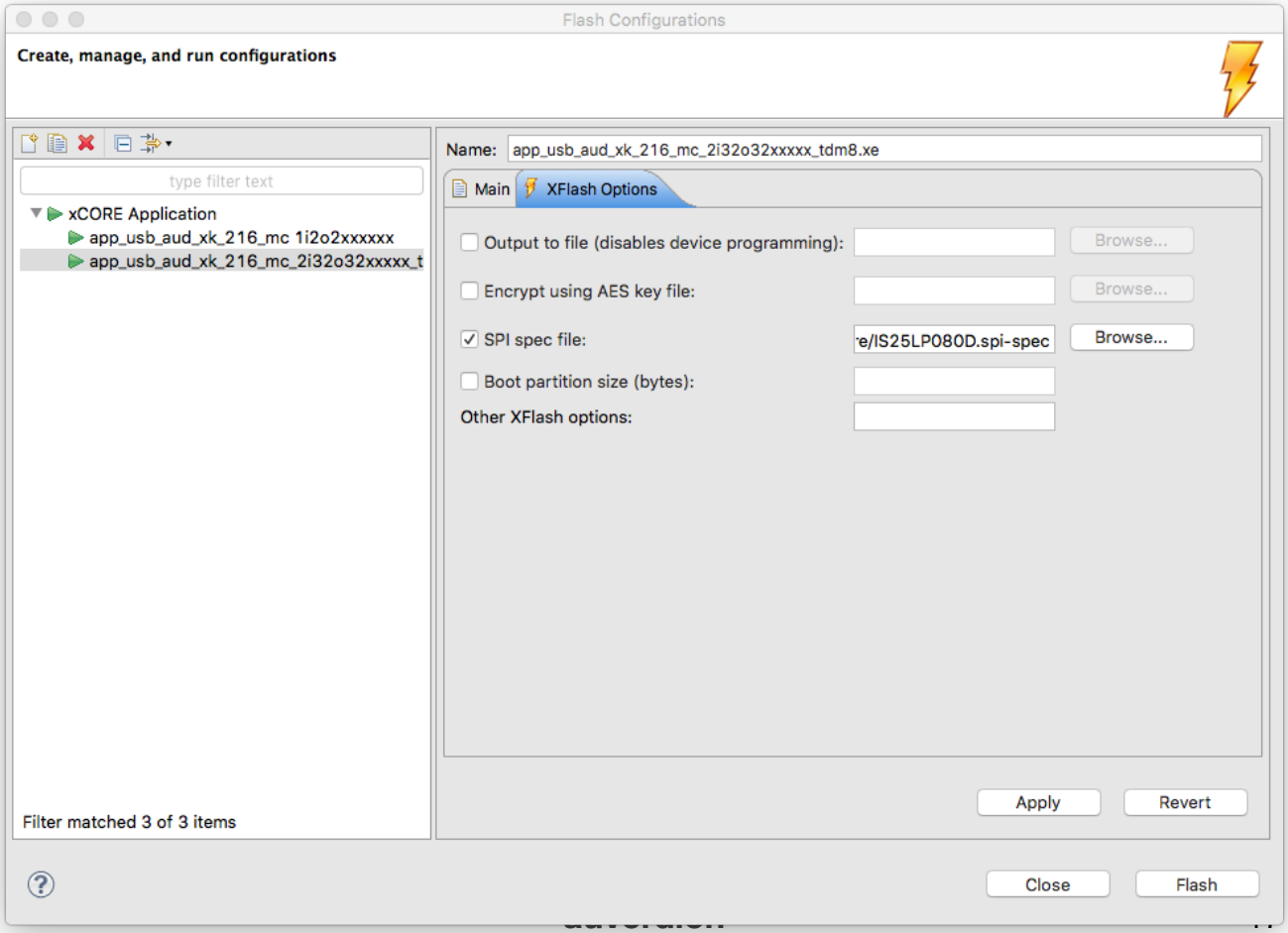
4. After download was completed and you restarted Arduino IDE you should see several ESP32-boards under *Tools->Board*. Please select *ESP Dev Module*.
5. Now connect your USB2Serial converter to X504. Please double check the pinout and the correct wiring. Then connect you USB2Serial converter to a USB port on your computer and power up the freeDSP-aurora board.
6. Select your USB2Serial converter under *Tools->Port*. You are now ready to program the latest firmware on your ESP32.
7. Open the file aurora.ino from the freeDSP-aurora repository.
8. Click *Sketch->Click/Verify*. The Arduino IDE should now build the firmware. After success click *Sketch->Upload* to upload the firmware to the ESP32 on your freeDSP-aurora board.
   Please note: For some USB2Serial converter the connection attempt fails. If that is the case for your converter you should press and release the reset button SW501 while you see the message *Connecting* in the Arduino IDE.
9. After a successful programming of the firmware and power off/on cycle of the freeDSP-aurora you should now be able to see your board in the list of available devices when you open the Bluetooth control panel of your computer.

10. Your are now ready to upload a DSP schematic. At any time you can make changes to the ESP32 firmware and upload it to the freeDSP-aurora board by repeating steps 4 to 9.

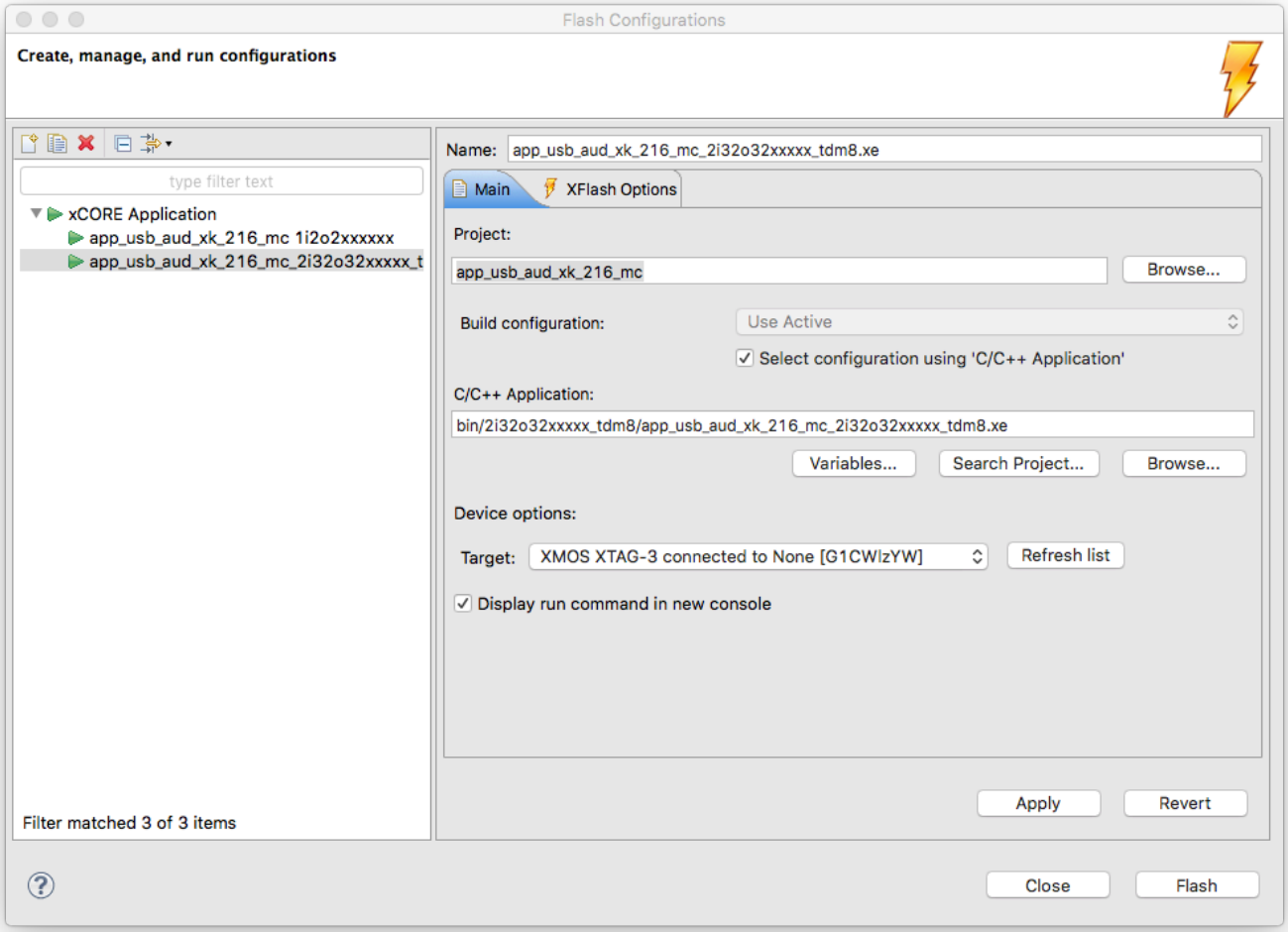
PROGRAMMING THE XMOS XE216-512-TQ128

If you want to use the features ADAT In/Out or Wordclock In/Out or USB Audio Class 2, you need to program the XE216-512-TQ128 to get the features working:

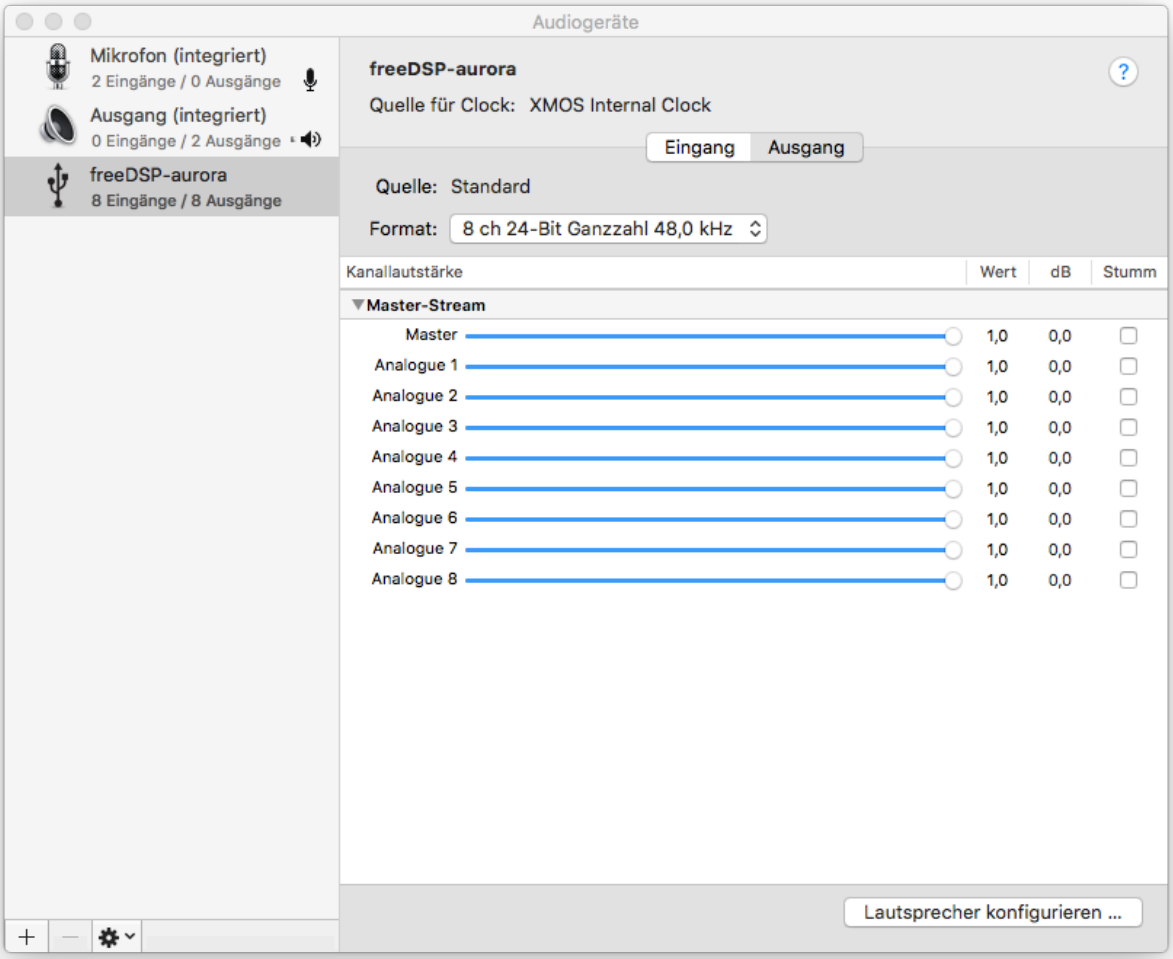
1. Download xTimeComposer Studio from https://www.xmos.com/support/tools without charge.
2. Download the XMOS USB Audio 2.0 Device Software Version: 6.15.2rc1 source code from http://www.xmos.com/published/usbaudiodevice-software?version=all without charge and import it into your xTimeComposer workspace.
3. Copy the files from <git repository>/SOURCE/XMOS/app_usb_aud_xk_216_mc to <workspace>/app_usb_aud_xk_216_mc. Confirm replacing existing files by the files from the git repository.
4. Connect the XMOS xTAG to X402 and to your computer.
5. To tell the programmer which SPI flash we are using go to *Run->Flash Configurations…* and change to tab *XFlash Options* and select IS25LP080D.spi-spec from the git repository for SPI Spec file.



6. After you have made sure that you are using the right flash configuration (see screenshot below) you are ready to flash the XE216-512-TQ128 by clicking on the *Flash* button.



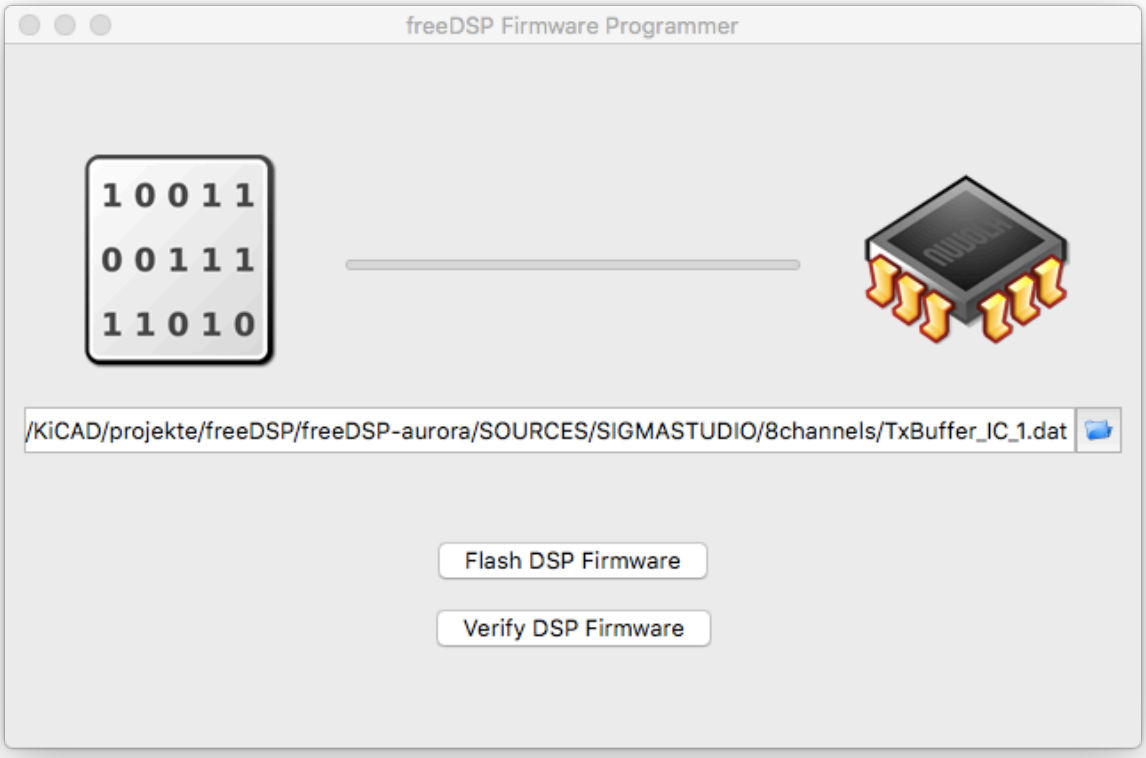
7. After success you should remove the xTAG and connect your freeDSP-aurora to your computer on the USB-B connector. It should now be enumerated by the operating system and e.g. for macOS being listed in the Audio-MIDI-Setup:


Audiogeräte
Mikrofon (integriert)
2 Eingänge / 0 Ausgänge
Ausgang (integriert)
0 Eingänge / 2 Ausgänge
freeDSP-aurora
8 Eingänge / 8 Ausgänge
freeDSP-aurora
Quelle für Clock: XMOS Internal Clock
Eingang
Ausgang
Quelle: Standard
Format: 8 ch 24-Bit Ganzzahl 48,0 kHz
Kanallautstärke
Wert
dB
Stumm
Master-Stream
Master 1,0 0,0
Analogue 1 1,0 0,0
Analogue 2 1,0 0,0
Analogue 3 1,0 0,0
Analogue 4 1,0 0,0
Analogue 5 1,0 0,0
Analogue 6 1,0 0,0
Analogue 7 1,0 0,0
Analogue 8 1,0 0,0
Lautsprecher konfigurieren ...

UPLOAD A DSP SCHEMATIC

PROGRAMMING THE ANALOG DEVICES ADAU1452 WITH DSPFWPROGRAMMER

To get your freeDSP-aurora working you need to upload at least one DSP schematic to the ADAU1452 DSP. You can find several ready to use DSP schematics in the repository. For uploading the software dspFwProgrammer is used. You can find executable binaries for many computer platforms in the repository. If you cannot find one for your computer you are free to recompile dspFwProgrammer for your computer.
Once you have started dspFwProgrammer insert the path to the *TxBuffer_IC_1.dat* file of DSP schematic you have chosen into the text box. You can also use the folder button and select the file by file dialog of your operating system:



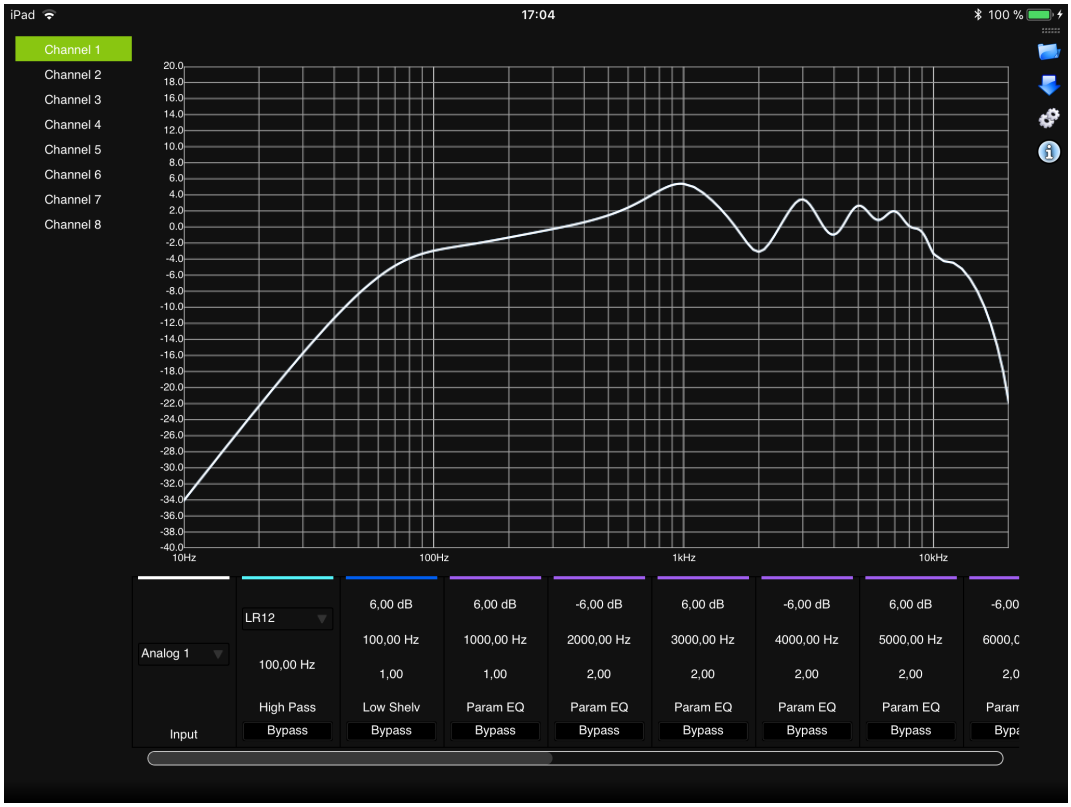
By clicking on *Flash DSP Firmware* you start the upload process. Once it has successfully finished and you run a power off/on cycle for the freeDSP-aurora board the DSP schematic is executed by the ADAU1452 DSP.
By clicking on *Verify DSP Firmware* you can verify that the programmed DSP schematic is the same as you have selected.
Some DSP schematics come with a control app for macOS, Windows or iOS. These apps provide remote control of the DSP schematic via WiFi or Bluetooth. You may need to install the desired app on your remote device. Please refer to the DSP schematic manual for details.
Currently the following DSP schematics are available in the repository:

8 Channel Loudspeaker Controller

The DSP schematic provides 8 channel strips with the following features per channel:

- Input select
- High pass up to fourth order
- Low shelving
- 10 parametric EQs
- High shelving
- Low pass up to fourth order
- Frequency depending phase shift (allpass)
- Phase inversion
- Delay 0…100ms
- Gain

This DSP schematic provides a control app for macOS, Windows, iOS.



PROGRAMMING THE ANALOG DEVICES ADAU1452 WITH SIGMASTUDIO

Although the ESP32 uploads the latest programmed DSP schematic to the DSP during boot you can upload a new schematic from SigmaStudio by using the USBi connector. This is very useful if you just want to test a new schematic you have built in SigmaStudio. Please note that uploads through SigmaStudio/USBi are volatile.

Connect your freeUSBi or your Analog Devices USBi programmer to X104. The upload itself can be done with SigmaStudio. The procedure is the same as in any other freeDSP based on ADAU1452. Please refer to manuals of other freeDSPs or the EVAL-ADAU1452MINIZ User Guide (http://www.analog.com/media/en/technical-documentation/user-guides/EVAL-ADAU1452MINIZ_User_Guide.pdf) for details about programming the DSP. SigmaStudio can be downloaded from http://www.analog.com/en/design-center/processors-and-dsp/evaluation-and-development-software/ss_sigst_02.html with no charge.

Make sure that jumper JP101 is installed.

When you are satisfied with your new DSP schematic you can store it non-volatile by using dspFwProgrammer as described in the previous section.

APPENDIX

PART LIST

Reference	Qty	Value1	Value2	Footprint	Order No. digikey
B101 B102 B103 B104	4	-	-	MountingHole_3.2mm_M3_DIN965_Pad	-
C103	1	5n60	10% 50V X7R	C0805-X7R	311-1134-1-ND
C101 C104 C111 C112 C114 C117 C119 C120 C122 C123 C125 C127 C132 C137 C259 C260 C337 C360 C409 C410 C412 C414 C415 C502	24	10u0	20% 25V X5R	C0805-X7R	490-10748-1-ND
C102 C105 C109 C110 C113 C118 C121 C124 C128 C129 C130 C131 C133 C134 C135 C136 C220 C230 C234 C242 C249 C261 C262 C264 C273 C274 C275 C276 C277 C278 C279 C280 C320 C328 C336 C344 C352 C361 C362 C363 C364 C365 C366 C367 C368 C369 C402 C403 C404 C405 C406 C407 C408 C411 C413 C501 C503	57	100n	5% 50V X7R	C0805-X7R	399-1170-1-ND
C106	1	150p	5% 50V C0G	C0805-X7R	399-1125-1-ND
C107 C108	2	22p0	5% 50V C0G/NP0	C0805-X7R	399-1113-1-ND
C115 C116 C126	3	330u	20% 25V	RD3.5_D8_L14	732-8635-1-ND
C201 C202 C209 C210 C215 C216 C225 C226 C235 C236 C245 C246 C253 C254 C267 C268	16	1n00	5% 50V PPS	C0805-X7R	PCF1328CT-ND

Reference	Qty	Value1	Value2	Footprint	Order No. digikey
C203 C204 C211 C212 C217 C218 C219 C227 C228 C229 C233 C237 C238 C241 C247 C248 C255 C256 C269 C270 C301 C302 C309 C310 C314 C315 C321 C324 C325 C329 C330 C331 C340 C341 C345 C346 C347 C353 C356 C357	40	100u	20% 25V	RD2_D5_L11	399-6102-ND
C205 C206 C213 C214 C221 C222 C231 C232 C239 C240 C251 C252 C257 C258 C271 C272	16	100p	5% 50V C0G/NP0	C0805-X7R	399-1122-1-ND
C207 C208 C223 C224 C243 C244 C265 C266	8	5n60	5% 16V PPS	C0805-X7R	PCF1193CT-ND
C250	1	4u70	20% 25V X5R	C0805-X7R	490-5422-1-ND
C263 C401	2	10n0	10% 50V X7R	C0805-X7R	311-1136-1-ND
C305 C306 C318 C319 C334 C335 C350 C351	8	27p0	5% 50V C0G/NP0	C0805-X7R	399-1114-1-ND
C307 C308 C322 C323 C338 C339 C354 C355	8	3n90	5% 16V PPS	C0805-X7R	PCF1191CT-ND
C313	1	1u00	10% 16V X7R	C0805-X7R	311-1365-1-ND
C303 C304 C311 C312 C316 C317 C326 C327 C332 C333 C342 C343 C348 C349 C358 C359	16	470p	2% 50V PPS	C0805-X7R	PCF1292CT-ND
C416	1	22u0	20% 10V X5R	C0805-X7R	490-10511-1-ND
C417 C418 C419 C420 C421 C422 C423 C424 C425 C426 C427 C428 C429 C430 C431 C432 C433 C434 C435 C436 C437 C438 C439 C440 C441	25	100n	10% 10V X7R	C_0402	490-6321-1-ND
D401	1	MBR120VLSFT	Schottky 20V 1 A	SOD123	MBR120VLSFT3GOSCT-ND

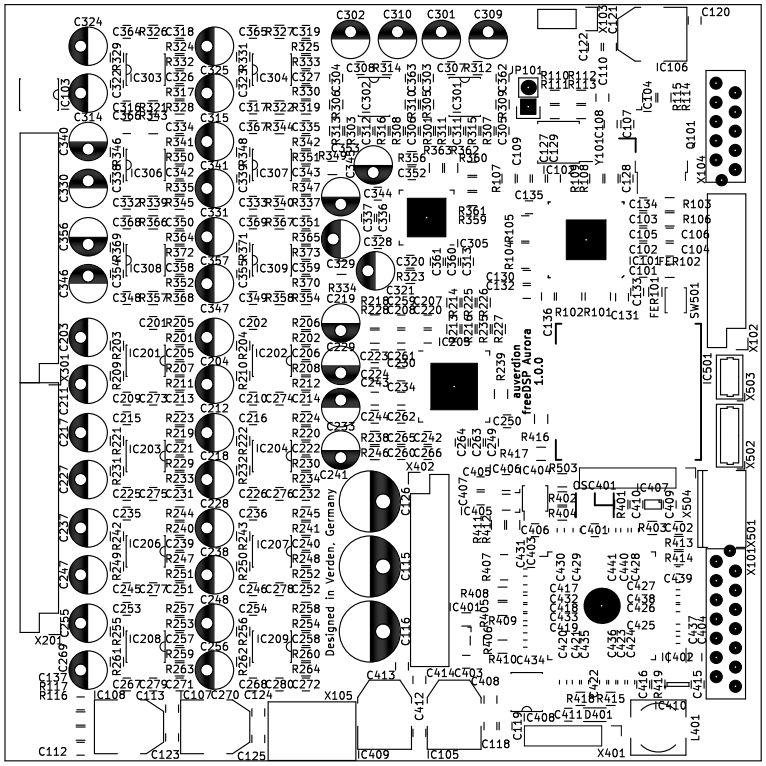
Reference	Qty	Value1	Value2	Footprint	Order No. digikey
FER101 FER102	2	600R	@100MHz 600mA	C0805-RES	490-1040-1-ND
IC101	1	ADAU1452	-	QFP72_10x10_EP_Handsoldering	ADAU1452WBCPZ-ND
IC102	1	DNP	1Mbit	SOIJ8_5.3x5.3mm_P1.27mm	-
IC103	1	TLE2426ID	Spannungsreferenz	SOIC-8_3.9x4.9mm_Pitch1.27mm	296-1345-1-ND
IC104	1	ADM811TARTZ	Spannungsmonitor	SOT143	ADM811TARTZ-REELCT-ND
IC105 IC107	2	LM1117MP-5.0	LDO	SOT223	LM1117MP-5.0/NOPBCT-ND
IC106 IC409	2	NCP1117LPST33	LDO	SOT223	NCP1117LPST33T3GOSCT-ND
IC108	1	LM1117MPX-ADJ	LDO	SOT223	LM1117MPX-ADJ/NOPBCT-ND
IC201 IC202 IC203 IC204 IC206 IC207 IC208 IC209 IC301 IC302 IC303 IC304 IC306 IC307 IC308 IC309	16	OPA1652AIDR	OpAmp	SOIC8_3.9x4.9mm_Pitch1.27mm	296-39101-1-ND
IC205	1	AK5558VN	ADC	QFN64_9x9mm_Pitch0.5mm_EP_Handsoldering	974-1128-1-ND
IC305	1	AK4458VN	DAC	QFN48_7x7mm_Pitch0.5mm_EP_Handsoldering	974-1082-1-ND
IC401	1	NC7WZ07	Noninverting Buffer	SC-70-6	NC7WZ07P6XCT-ND
IC402	1	NC7SZ175	D-Type Flip-Flop with Asynchronous Clear	SOT-363_SC-70-6	296-16998-1-ND
IC403	1	XE216-512-TQ128	xCore	TQFP-128_14x14mm_Pitch0.4mm_EP_Handsoldering	880-1096-ND
IC404	1	CS2100CP	Fractional-N Clock Multiplier	MSOP-10_3x3mm_Pitch0.5mm	598-1750-ND
IC405 IC406	2	NC7SZ157	2-Input Non-Inverting Multiplexer	SC-70-6	NC7SZ157P6XCT-ND

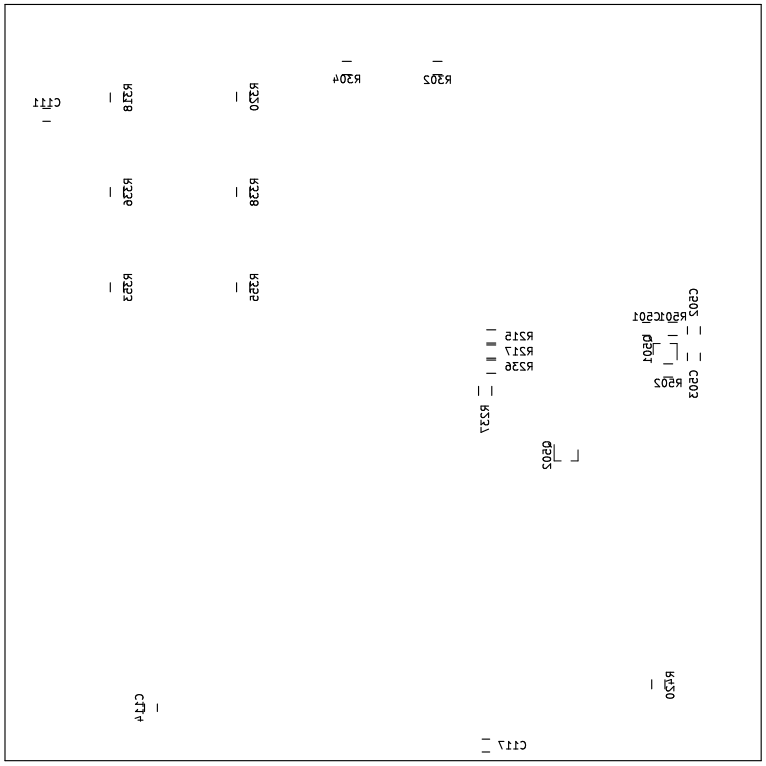
Reference	Qty	Value1	Value2	Footprint	Order No. digikey
IC407	1	NCP4681DSQ25T1G	2,5V 150mA	SC-70-5	NCP4681DSQ25T1GOSCT-ND
IC408	1	IS25LP080D	8Mb	SOIC8_3.9x4.9mm_Pitch1.27mm	706-1580-ND
IC410	1	TLV62565	1.5A	SOT-23-5	296-43657-1-ND
IC501	1	ESP32-WROOM-32U	Module	ESP32-WROOM-32U	1904-1026-1-ND
J101	1	Jumper	-	HDR_01x02	732-5315-ND
L401	1	2u20	30% 4.5A 26 mOhm	MCSDRH73B	811-1157-1-ND
OSC401	1	24M0	-	ASFL1	300-8252-1-ND
Q101	1	STD2805	PNP 60V 5A 150MHz 15W	TO-252-2Lead	497-7465-1-ND
Q501 Q502	2	SS8050-G	-	SOT-23	641-1790-1-ND
R101 R102 R104 R105 R407	5	33R0	5% 62,5mW	R_Array_Convex_4x0603	TC164J-33CT-ND
R103 R114 R410	3	1K00	1% 0.125W Thick	C0805-RES	311-1.00KCRCT-ND
R106	1	4K32	1% 0.125W Thick	C0805-RES	311-4.32KCRCT-ND
R108	1	100R	1% 0.125W Thick	C0805-RES	311-100CRCT-ND
R109 R239 R402 R404 R408 R409 R411 R412	8	33R0	1% 0.125W Thick	C0805-RES	311-33.0CRCT-ND
R110 R111 R416 R417	4	2K00	1% 0.125W Thick	C0805-RES	311-2.00KCRCT-ND
R107 R112 R113 R401 R405 R406 R413 R414 R501 R502 R503	11	10K0	1% 0.125W Thick	C0805-RES	311-10.0KCRCT-ND
R115 R418	2	100K	1% 0.125W Thick	C0805-RES	311-100KCRCT-ND
R117	1	931R	1% 0.125W Thick	C0805-RES	311-931CRCT-ND
R201 R202 R207 R208 R219 R220 R229 R230 R240 R241 R247 R248 R253 R254 R259 R260	16	620R	0.5% 0.1W Thin	C0805-RES	RR12P620DCT-ND
R203 R204 R209 R210 R221 R222 R231 R232 R242 R243 R249 R250 R255 R256 R261 R262	16	976R	0.5% 0.1W Thin	C0805-RES	408-1761-1-ND

Reference	Qty	Value1	Value2	Footprint	Order No. digikey
R218 R228 R238 R246 R323 R334 R349 R356	8	20R0	1% 0.125W Thick	C0805-RES	311-20.0CRCT-ND
R225 R226 R227	3	47K0	1% 0.125W Thick	C0805-RES	311-47.0KCRCT-ND
R213 R214 R215 R216 R217 R235 R236 R237 R359 R360 R361 R362 R363	13	0R00	1% 0.125W Thick	C0805-RES	311-0.0ARCT-ND
R205 R206 R211 R212 R223 R224 R233 R234 R244 R245 R251 R252 R257 R258 R263 R264	16	10R0	1% 0.25W Thin	C0805-RES	RNCP0805FTD10R0CT-ND
R301 R303 R311 R313 R317 R319 R328 R330 R335 R337 R345 R347 R352 R354 R368 R370	16	4K42	0.5% 0.1W Thin	C0805-RES	RR12P4.42KDCT-ND
R302 R304 R315 R316 R318 R320 R332 R333 R336 R338 R350 R351 R353 R355 R372 R373	16	3K40	0.5% 0.1W Thin	C0805-RES	RR12P3.4KDCT-ND
R116 R305 R306 R312 R314 R321 R322 R329 R331 R339 R340 R346 R348 R357 R358 R369 R371	17	150R	1% 0.25W Thin	C0805-RES	RNCP0805FTD150RCT-ND
R307 R308 R309 R310 R324 R325 R326 R327 R341 R342 R343 R344 R364 R365 R366 R367	16	4K70	1% 0.125W Thin	C0805-RES	YAG3364CT-ND
R403	1	4R70	1% 0.125W Thick	C0805-RES	311-4.70CRCT-ND
R415	1	43R2	1% 0.125W Thick	C0805-RES	P43.2CCT-ND
R419	1	80K6	1% 0.125W Thick	C0805-RES	311-80.6KCRCT-ND
R420	1	120K	1% 0.125W Thick	C0805-RES	311-120KCRCT-ND
SW501	1	B3U-1000P	SWITCH TACTILE SPST-NO 0.05A 12V	SW_SPST_B3U-1000P	SW1020CT-ND
X101	1	MicroMatch-14	-	MM-14G	A110871CT-ND

Reference	Qty	Value1	Value2	Footprint	Order No. digikey
X102	1	HDR_02x08	-	HDR_02x08	S2011EC-08-ND
X103	1	HDR_01x03	-	HDR_01x03	1849-1003-ND
X104	1	MicroMatch-10	-	MM-10G	A110869-ND
X105	1	MicroFit3 02x02	-	Microfit3_43045-0428	WM10670-ND
X201 X301	2	SKT_02x13	-	HDR_02x13	S2011EC-13-ND
X401	1	HDR-01x05	-	HDR_01x05	S1011EC-05-ND
X402	1	HDR-02x10	-	HDR_02x10	S2011EC-10-ND
X501	1	KK254-01x04	-	Molex_KK254_0022032041	WM4202-ND
X502	1	PB-01x05	-	Molex_PicoBlade_530470510	WM1734-ND
X503	1	PB-01x03	-	Molex_PicoBlade_530470310	WM1732-ND
X504	1	HDR-01x06	-	PinHeader_1x06_P2.54mm_Vertical	S1011EC-06-ND
Y101	1	24M576	-	rklib:Crystal-3.2x2.5	SER3690CT-ND

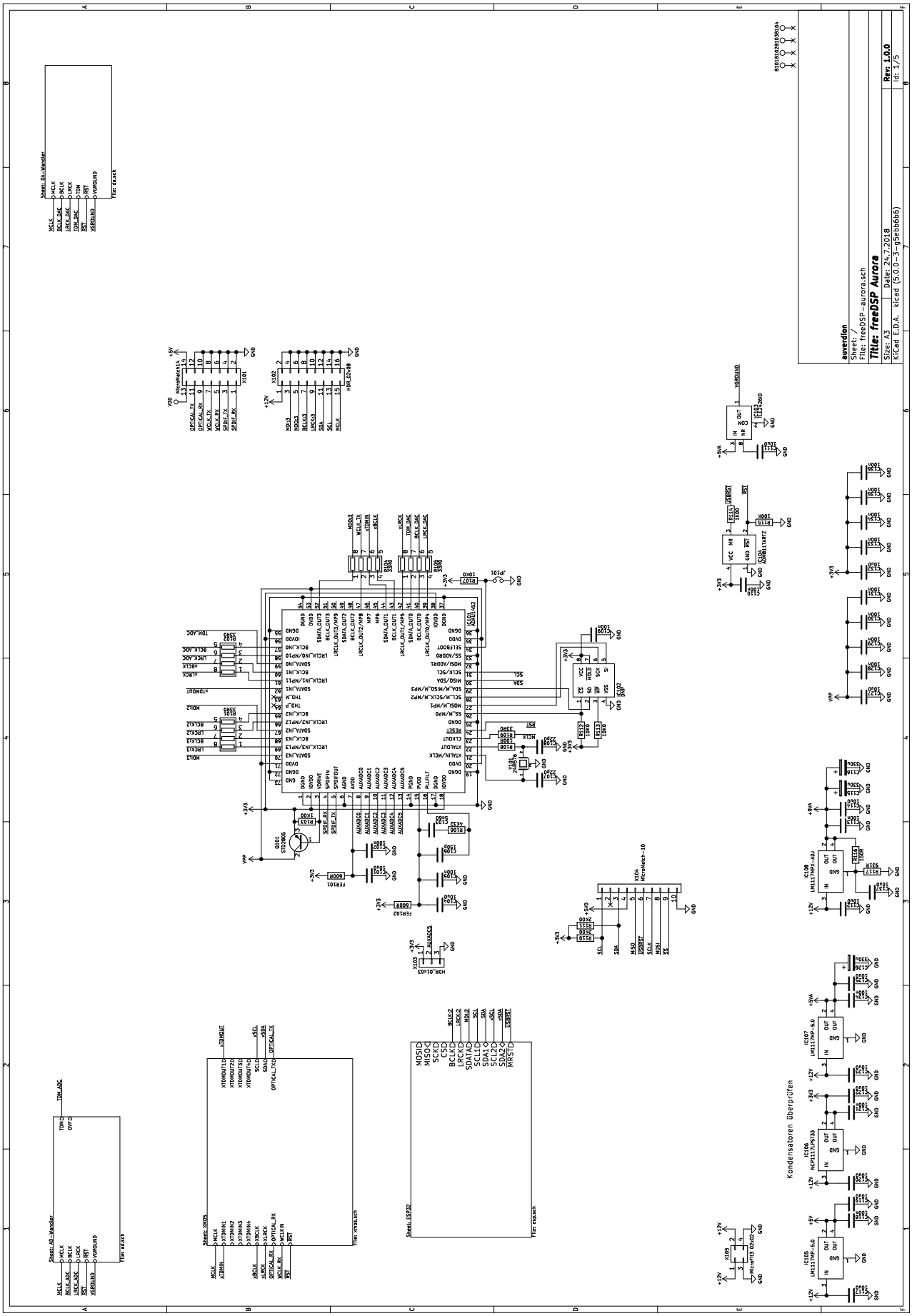
ASSEMBLY PRINT





SCHEMATIC

TODO: Update schematics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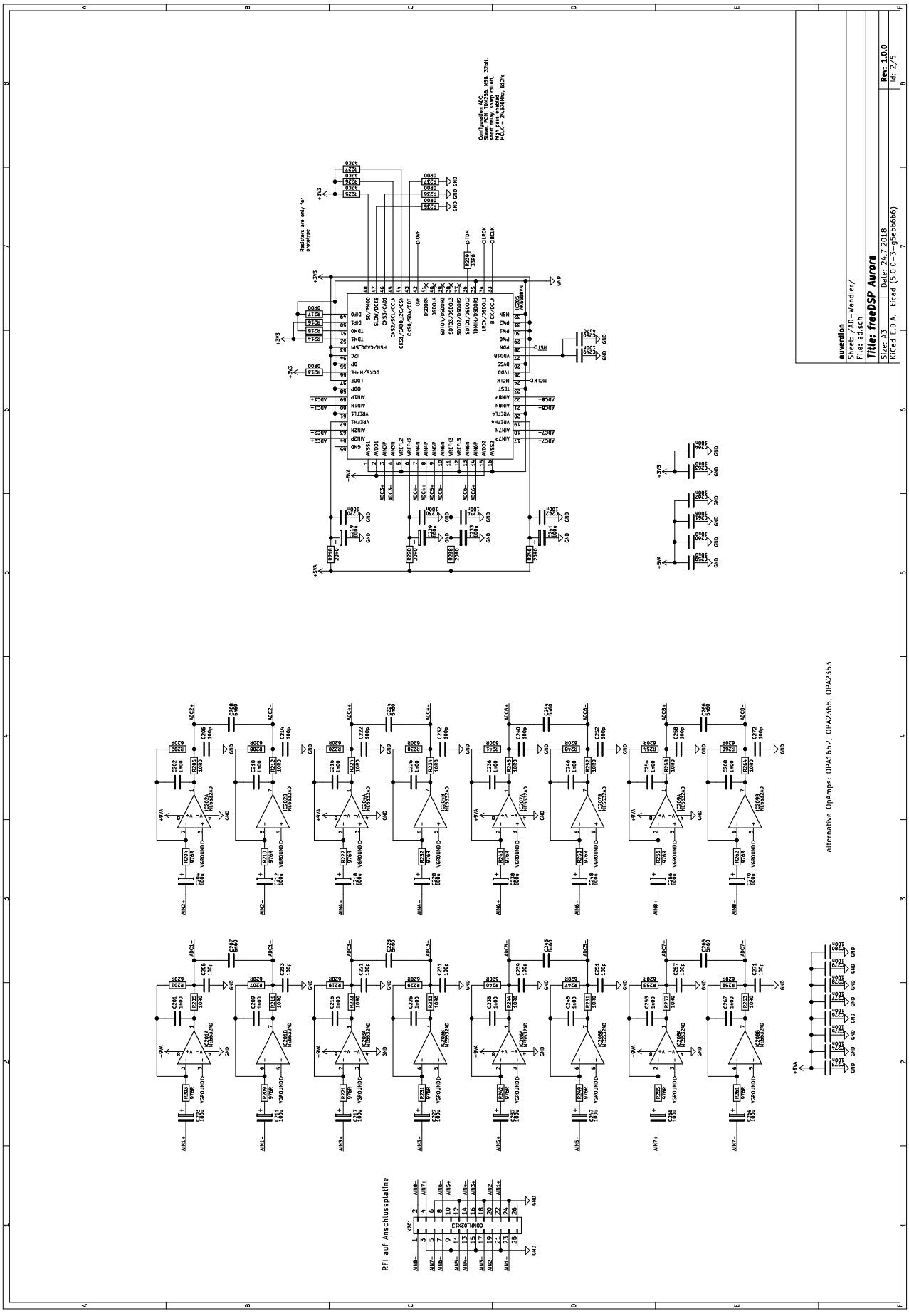
Title: freeDSP Aurora
Size: A3
Date: 24.7.2018
Rev: 1.0.0
KiCad E.D.A. kicad (5.0.0-3-g5ebb6b6)
Id: 1/5
Kondensatoren überprüfen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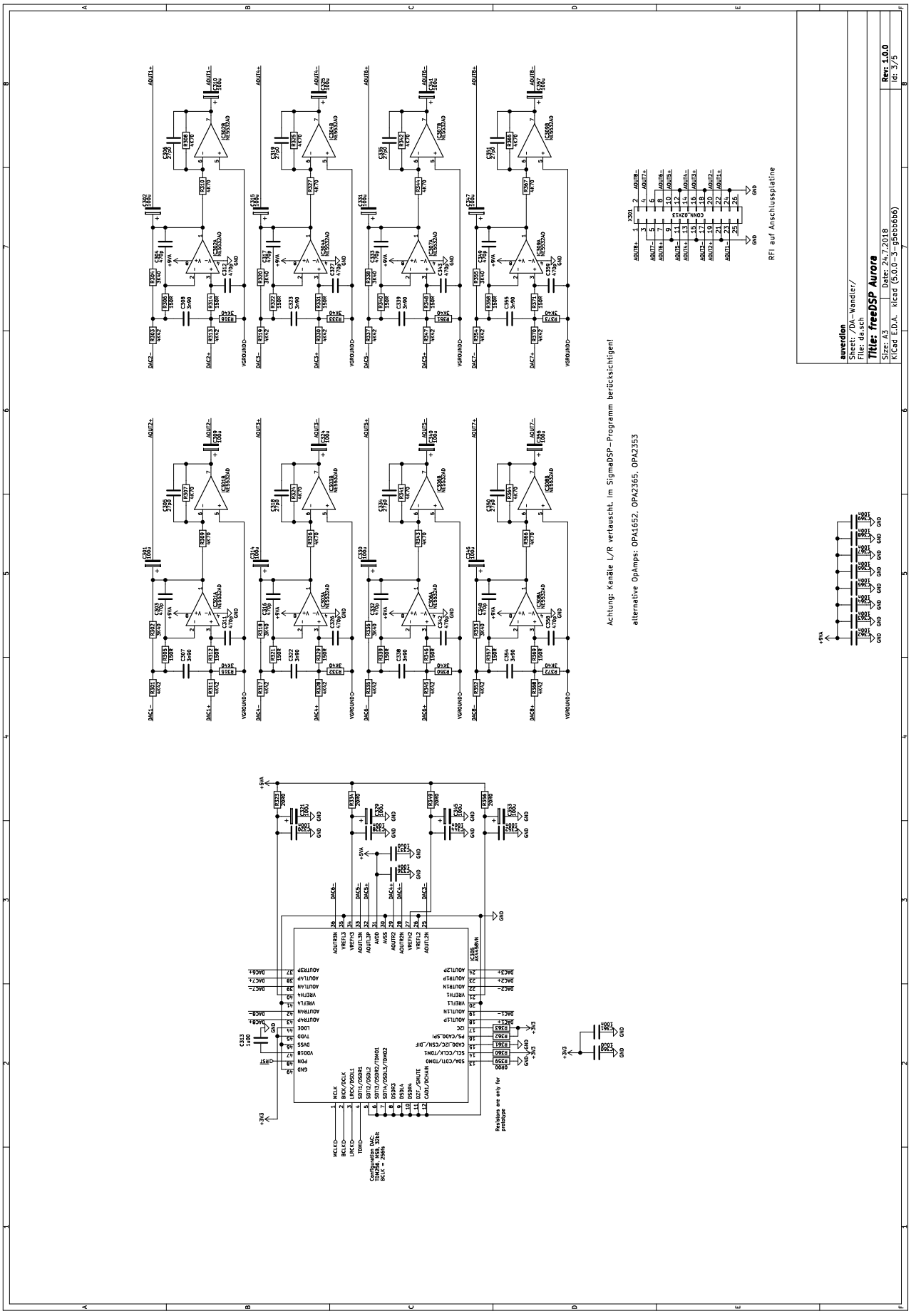
File: ad.sch
Title: freeDSP Aurora
Size: A3
Date: 24.7.2018
Rev: 1.0.0
KiCad E.D.A. kicad (5.0.0-3-g5ebb6b6)
Id: 2/5
Configuration ADCs:
Slave mode, 24bit, MSB, 32bit,
short delay, sharp rolloff,
high performance
MCLK = 24,576MHz, 512fs
Resistors are only for prototype
alternative OpAmps: OPA1652, OPA2365, OPA2353
RFI auf Anschlussplatine


Achtung: Kanäle L/R vertauscht. im SigmaDSP-Programm berücksichtigen!
alternative OpAmps: OPA1652, OPA2365, OPA2353
RFI auf Anschlussplatine
auverdion
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Rev: 1.0.0
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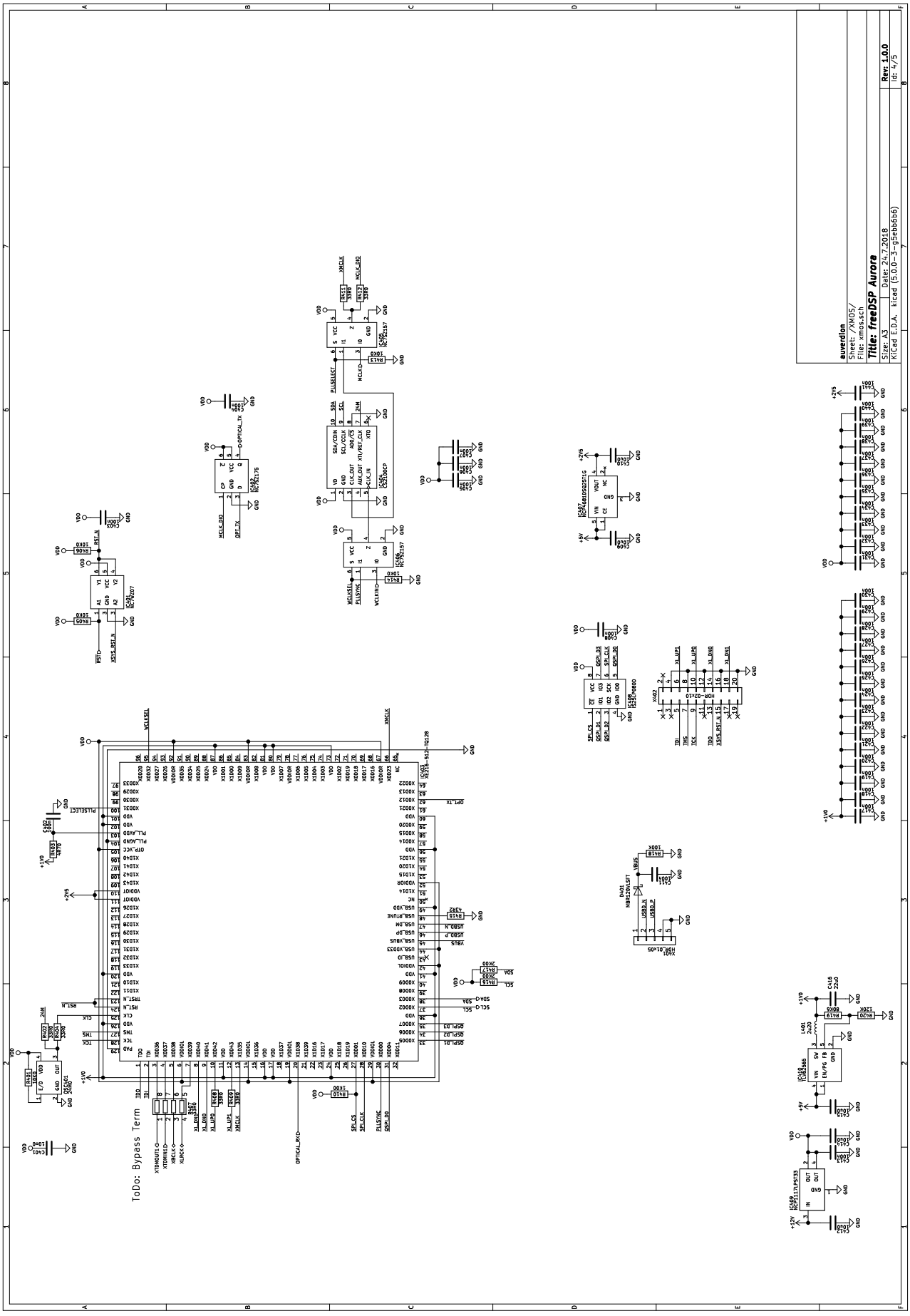
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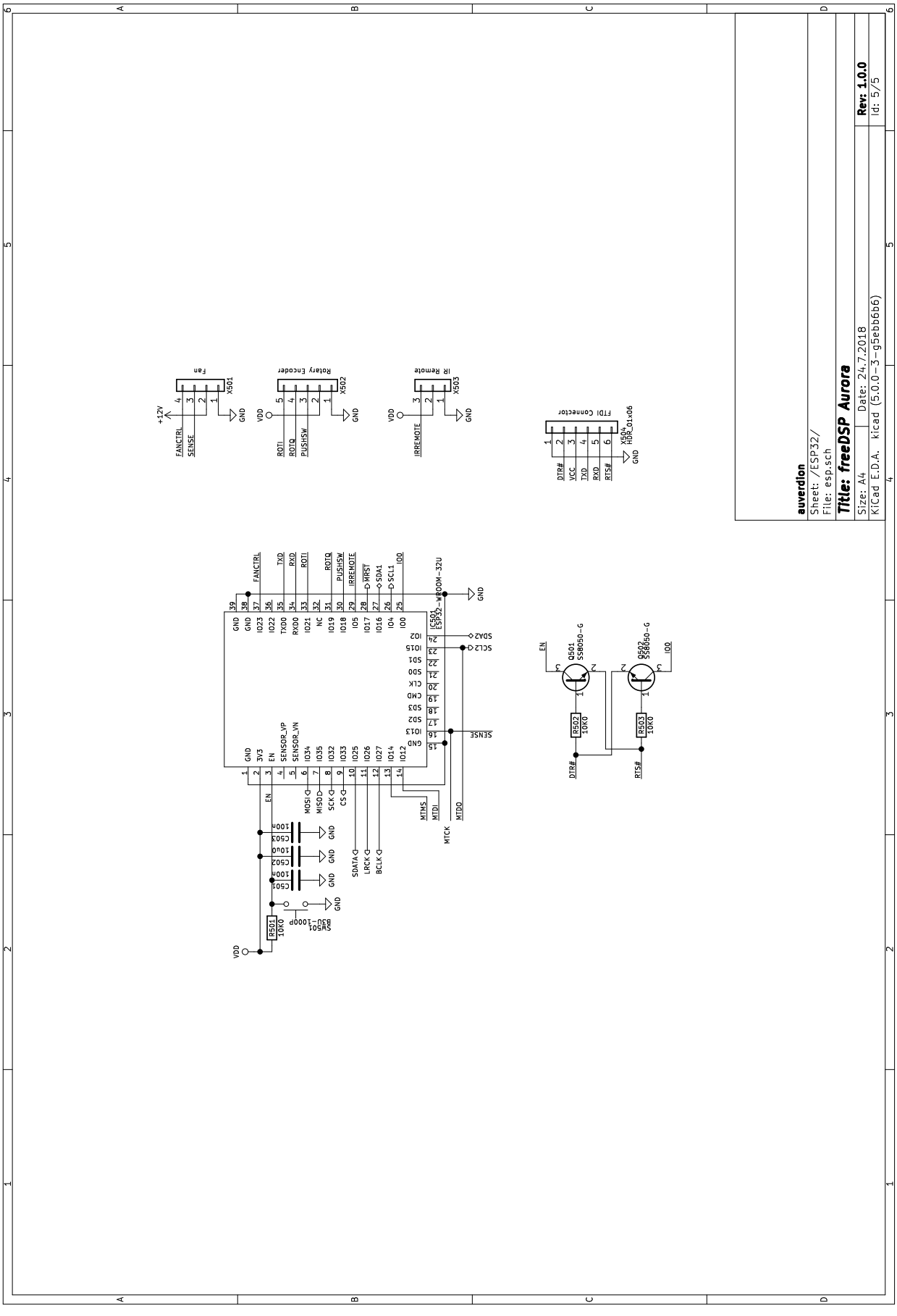
ToDo: Bypass Term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Size: A4
Date: 24.7.2018
Rev: 1.0.0
KiCad E.D.A. kicad (5.0.0-3-g5ebb6b6)
Id: 5/5
Fan
Rotary Encoder
IR Remote
FTDI Connector
ESP32-WROOM-32U