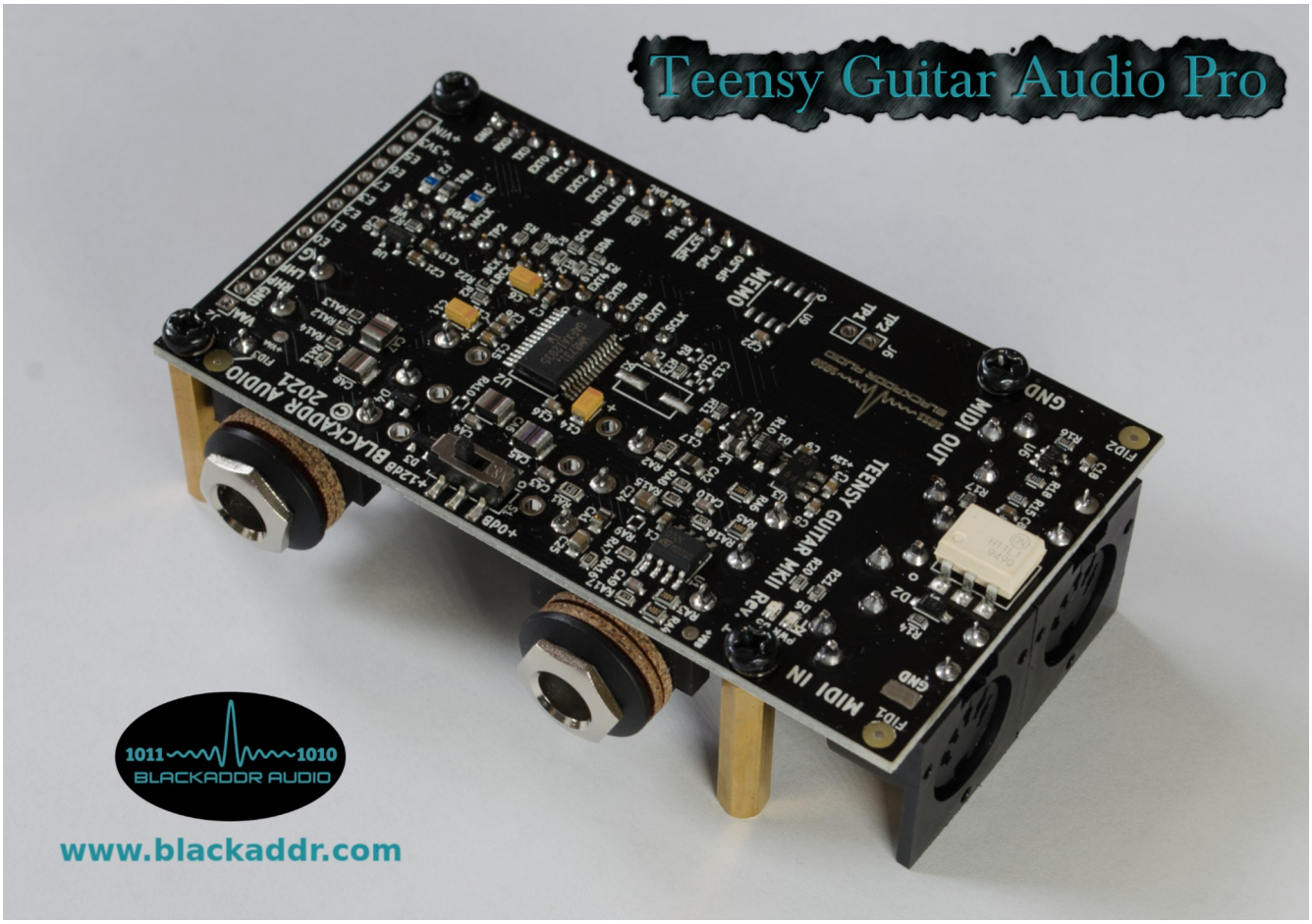
Blackaddr Audio

www.blackaddr.com

Teensy Guitar Audio Series

TGA Pro MKII
User Guide v2.2
(PCB Rev 1)



Revision History

V2.0 - April 2, 2021 – Initial Release for the MK II

V2.1 – May 11, 2021 – Fixed hyperlink to BALibrary

V2.2 – April 13, 2022 – Update memory information to 64Mbit. Added Troubleshooting.

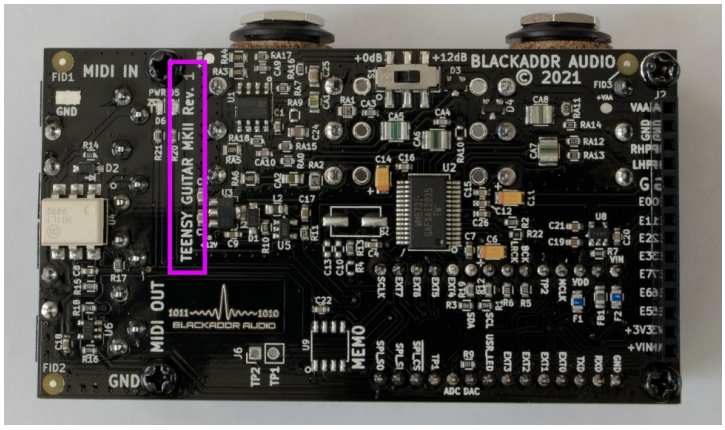
Identify Your Hardware Revision

When building programs for your TGA Pro, you will have to specify in the Arduino setup() function the correct hardware revision you have to ensure all the I/O are mapped correctly.

```
void setup() {
    // ...
    TGA_PRO_MKII_REV1(); // Declare the version of the TGA Pro you are using.
    // ...
}
```

This manual is for the MKII Rev 1 model. The TGA Pro model version is printed on the silkscreen in the same location on all hardware revisions.

Please note the Expansion Board has a different revision number on it and should not be confused with the revision of the TGA Pro mainboard shown below.



If you have one of the older hardware versions, please refer to the specific manual for those versions as the connections and options may be different.

This manual is not for previous TGA Pro Releases:

- REVB
- REVA

TGA Pro MKII Overview

The TGA Pro MKII from Blackaddr Audio is a combined Audio and MIDI shield. This stereo-sound prototyping board is specifically designed for learning about and designing your own digital effects. It can also be easily integrated into a custom project using the schematic and mechanical information provided in this manual.

Teensy-3.X and Teensy 4.X are a series of Arduino-software compatible microcontroller boards by PJRC (www.pjrc.com) that offer significantly improved processing power (up to 600 Mhz) over regular Arduino boards making them ideal for real-time audio applications.

What sets the TGA Pro apart form other boards is it is specifically designed for connecting a wide range of audio sources. On-board high-impedance preamps with adjustable gain permit direct connection of a wide range of instruments and equipment including guitars, guitar pedals, or line-level sources using the full size 1/4” audio jacks you are used to. Guitars in particular have a wide range of signal levels ranging from tens of millivolts for passive vintage pickups up to potentially 9V with active pickups or conventional guitar pedals!

A wide range of adjustable gain or attenuation is required in order to accommodate any instrument. A challenge adeptly handled by the TGA Pro.

Choosing a Teensy

The TGA Pro platform supports a number of both Teensy 3 and Teensy 4 series microprocessor boards. The native socket is 28-pin which takes the Teensy 4.0 directly and by using socket adapters other Teensy’s may be used as well.

Teensy 4.0 - this plugs directly into the TGA Pro MKII.

Teensy 4.1 - this can plug directly into the TGA Pro MKII with the extra pins overhanging the socket. See installation photos in the section: Compatibility, later in this manual. To take advantage of the extra pins on the Teensy 4.1 it is recommended to get the ***T4.1 Breakout Board*** socket adapter. These extra pins will allow the use of even more switches, pots, LEDs, etc. in your project.

Teensy 3.2/3.5/3.6 - The Teensy 3 series uses a different pinout for audio versus the Teensy 4 series. Teensy 3 is supported by the TGA Pro using the ***T3 Breakout Board*** socket adapter. This adapter will compensate for the different T3 pinout as well provide access to many more unused pins on the T3 for additional pots, switches, LEDs, etc.

Key Features

- Compatible with Teensy 3.2, 3.5, 3.6 or 4.0, 4.1
- Isolated, clean analog power supplies for analog/digital converters and preamp are generated on-board from the Teensy supplied USB power.
- Overall +24dB to -34.5dB of user-controllable input gain/attenuation.
- 2-channel input, 2-channel output configuration allows you to process signals from other stereo sources such as keyboards, stereo guitar pedals (such as reverb, chorus, etc.) or create your own mono-to-stereo effects.
- Optional 64-Mbit SPI RAM for external data storage (ideal for long delays, buffers, wavetables).
- Optional Expansion Control Board provides physical pots and switches.
- GPIOs available on user-installable expansion headers allow connecting pots, switches, and LEDs.
- Standard 5-pin MIDI input and output connections for use with Arduino MIDI library.
- Optional analog dry output jack passively splits out the output of the analog preamp.
- 1 user-controllable on-board status LED.
- Overload protection circuit for CODEC analog input.

ADDITIONAL RAM: Please note the external RAM chips provide extra storage via the Teensy SPI peripherals. They can be used for external storage of data, for example wavetables for tube modelling, large audio buffers for longer delays, etc. They do not increase program memory which stores the executable code and variables for your program.

Accessories

Additional RAM

An additional 64-Mbit SRAM can be added at the time of purchase. This memory provides temporary storage of data in order to leave more of the built-in RAM available for running larger programs. This memory is fast enough for moving audio data in realtime, something not always possible with Flash-based memory. The additional memory can be used to store any type of data, but common examples include:

- Audio Delay. 64-Mbit provides up to 95 seconds of mono delay capability. Audio delays can quickly consume the on-chip program RAM, it’s best to implement them with external memory.

- Audio Buffers. Projects recording audio to or reading from Flash memory find that fast audio buffers are needed in order to ensure no lost samples.
- Wavetables. Non-linear effects such as tube distortion often use pre-computed wavetables. These can be stored on Teensy MicroSD flash (T3.5/T3.5/T4.1) then loaded into faster external SRAM, saving both built-in Flash and RAM for storing and running your program.
- Graphics Data. If adding a display to your project, graphic sprites can be stored in SRAM for faster retrieval versus Flash memory to have a more responsive user interface.

T4.1 Breakout Board

The T4.1 Breakout Board provides access to almost all of the unused Teensy 4.1 pins. The breakout board also allows you to solder wires to an inexpensive, replaceable component.

This option contains two PCBs. A socketed PCB with all male and female headers installed, and a bare PCB for those wishing to achieve minimum height by soldering the T4.1 directly to it.

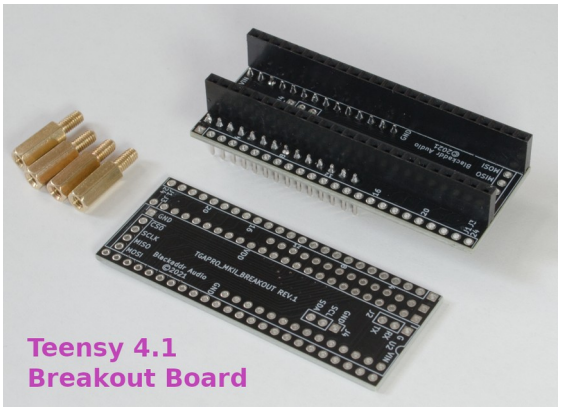


Figure 1: Teensy 4.1 Breakout Board

T3 Adapter / Breakout Board

The T3 Adapter Board allows use of a Teensy 3 series microprocessor board with the TGA Pro MKII. This board also doubles as a breakout board, providing access to to almost all of the unused pins on a Teensy 3.5/3.6.

This option contains two PCBs. A socketed PCB with all male and female headers installed, and a bare PCB for those wishing to achieve minimum height by soldering the T3 directly to it.

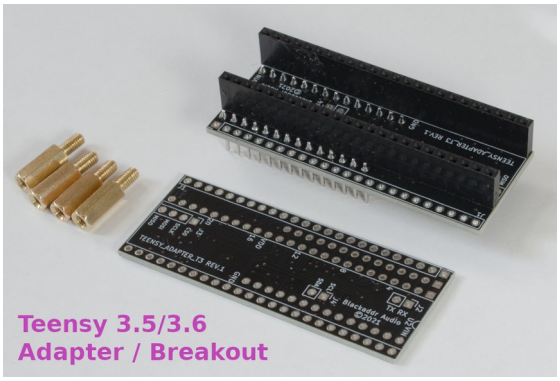


Figure 2: Teensy 3.5/3.6 Adapter / Breakout Board

Expansion Control Board

An Expansion Control Board is available to supplement your TGA Pro MKII. This add-on provides physical controls and is the recommended way to learn how to master adding buttons/switches and knobs to your project.

By using pre-built hardware, and examining the provided free demo code to go with it, you'll spend less time debugging things like switch bounce and potentiometer calibration. The Expansion Control Board schematic is included at the end of this manual, so you can use it as reference for your own designs!

The Blackaddr Audio Expansion Control Board contains the following:

- 2 soft-touch momentary push-button switches.

- 3 potentiometers
- 2 LEDs
- Headphone circuit and 3.5mm TRS jack. (The built-in headphone amp volume is controlled digitally through the CODEC via BAAudioControlWM8731::setHeadphoneVolume()).

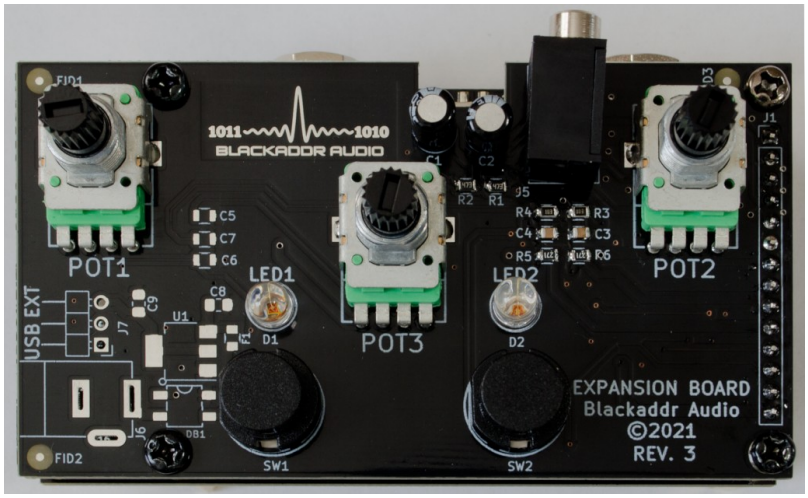


Figure 3: Expansion Control Board

By combining the Expansion Control Board with the TGA Pro MKII, you have everything you need to get audio in and out of the Teensy, as well as physical controls without any need for soldering. You can start auditioning effects and writing your own immediately.

The following table lists which logical pins on the Teensy connect to the Expansion Control Board.

Control	Symbolic name in BALibrary	Logical Pin number on Teensy 4.X	Logical Pin number on Teensy 3.5/3.6
POT1	BA_EXPAND_POT1_PIN	A0	A16
POT2	BA_EXPAND_POT2_PIN	A1	A17
POT3	BA_EXPAND_POT3_PIN	A2	A18
SW1	BA_EXPAND_SW1_PIN	2	2
SW2	BA_EXPAND_SW2_PIN	3	3
LED1	BA_EXPAND_LED1_PIN	4	4
LED2	BA_EXPAND_LED2_PIN	5	6

Installing Standoffs

If using the Expansion Control Board, you will need to install the long HEX standoffs on the same side of the board as the Teensy and connectors. To ensure fit, avoid wide microUSB plugs and align the flat side of the HEX standoff towards the plug. See the figure below for guidance (centre image below).

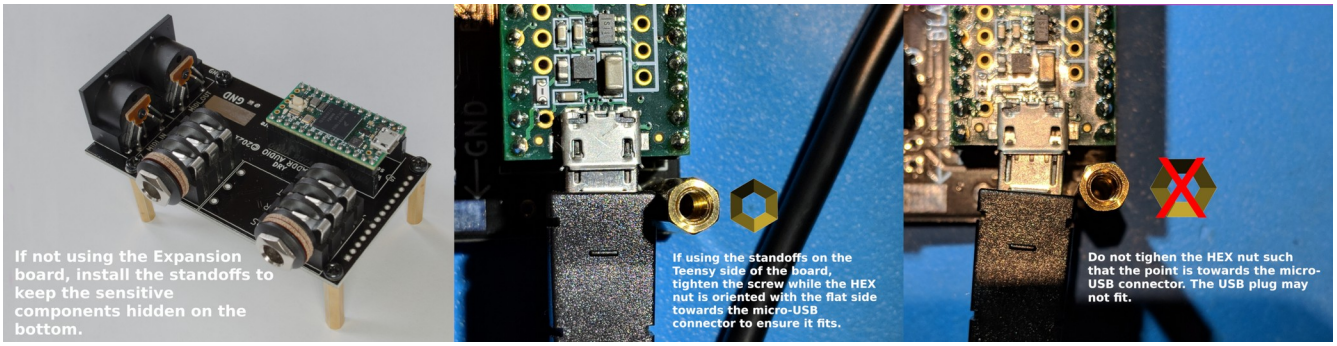


Figure 4: Correct Standoff Installation

If you are not using the Expansion Control Board, it's best to mount the standoffs such that the sensitive electronic components are hidden on the bottom. (Left image above). This makes handling the board easier, and permits any size micro-USB plug.

Technical Specifications

Input Channels (unbalanced) : 2

Output Channels (unbalanced) : 2

Input Impedance: approx. 1 Mohm

Maximum INPUT signal level: 9 Vpp

Maximum OUTPUT signal level: 1 Vrms

Maximum CODEC input level: 1 Vrms

Overall Input Gain: +24 dB to -34.5 dB via 2-stage preamp

1st Stage Preamp Gain: switchable 0dB / +12dB via mechanical onboard switch

2nd Stage Preamp Gain: software controllable CODEC provides additional +12dB to -34.5dB gain

Input Signal Levels

Most audio signals fall in to one of four general groups in order of descending (lower) signal voltage level. Understanding them will help ensure the preamp gain is set correctly for your application.

- Speaker / Headphone Level (greatest voltage)
- Line Level
- Instrument Level
- Microphone Level (lowest voltage)

The preamp circuit on the TGA Pro is powered by +9V, just like a guitar pedal, thus it can safely take a voltage up to 9V peak-to-peak without damage. Note however that as signals near the maximum voltage, this will cause the preamp to distort and clip.

The goal with setting preamp gain is to either raise or lower the voltage to 1 Vrms (minus some headroom) using the preamp stages. This gives the ideal signal level for the CODEC to obtain the best signal-to-noise ratio and sound fidelity.

Speaker / Headphone Level – generally these types of levels are meant to drive actual speakers. However, headphone level from things like smart phones and music players are low enough to connect to the TGA Pro inputs as long as the volume on the source isn't set too high. Start at zero and bring it up. Too high of a signal from a headphone jack can potentially damage the TGA Pro inputs.

Line Level – these signals are usually around 1V RMS, ideal for the CODEC. Set the TGA Pro switch for 0dB of gain. It usually isn't necessary to adjust the software controlled gain in this scenario much, if at all. These can always be safely plugged into the INPUT jack on the TGA Pro.

Instrument Level – these signals are usually assumed to be from guitar pickups. Passive pickups can be as low as 20 mV. Humbuckers are much 'hotter' and are often 100 mV to 400 mV. Active pickups are as high as several volts. Guitar pedals can also be several volts peak-to-peak. The two-stage preamp design of the TGA Pro is intended to give you either the gain, or attenuation, you need for your instrument.

Microphone Level – these signals are often very weak, requiring +20 dB to as high as +60 dB of gain for dynamic mics. For best results when using a microphone, use a proper microphone preamp before connecting to the TGA Pro INPUT.

Compatibility

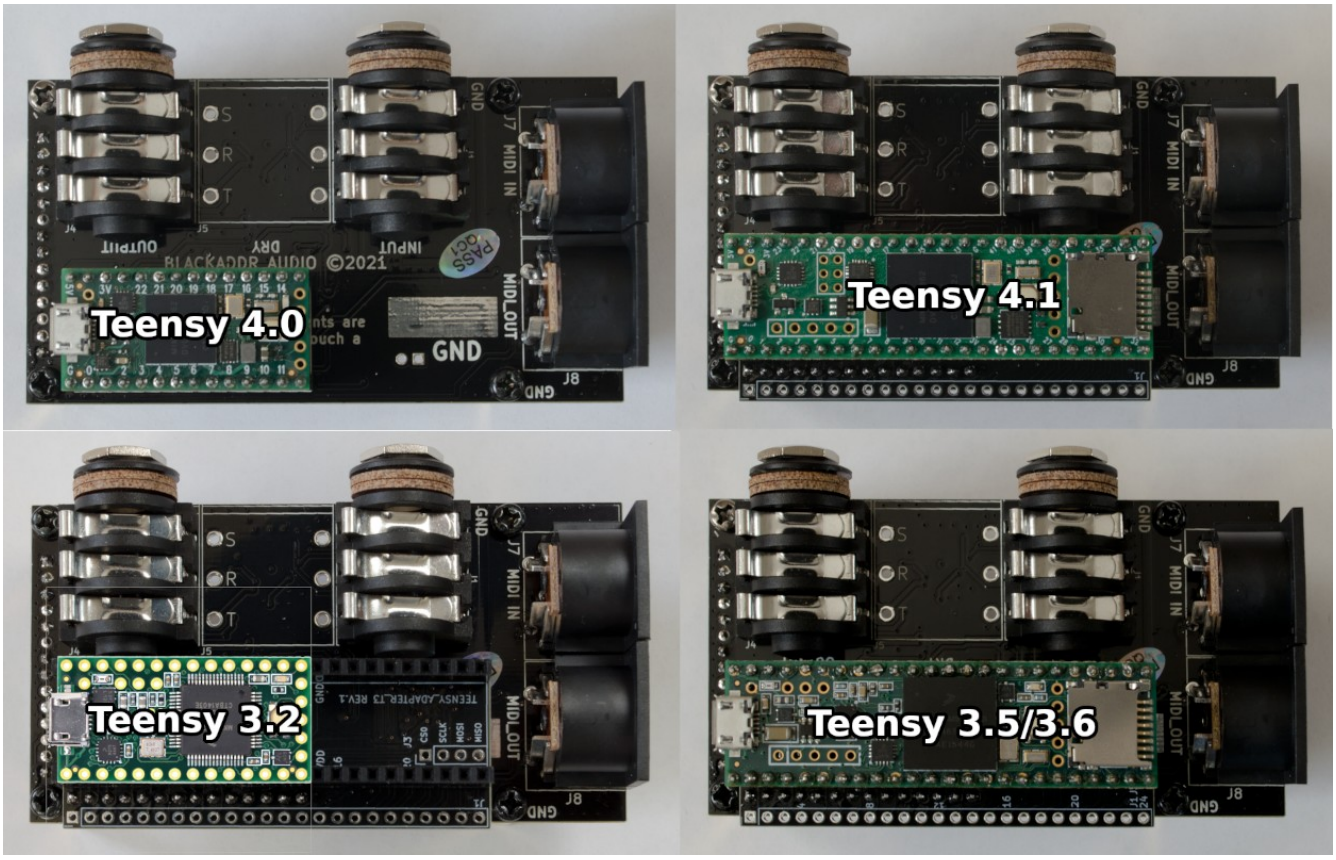


Figure 5: Teensy Compatibility and Orientation

The TGA Pro is designed to work with the following boards from PJRC (www.pjrc.com)

- Teensy 4.0
- Teensy 4.1 (optionally uses the T4 Breakout Board to access extra I/O)
- Teensy 3.2 / 3.5 / 3.6 (requires the T3 Adapter Board)

Please note that when installing the microprocessor, the USB connector is always on the **opposite** side of the MIDI jacks. When installing any Teensy, ensure all pins are correctly aligned in the socket. Installing the Teensy with incorrect pin alignment can damage the Teensy or TGA Pro.

The 48-pin Teensy 4.1 can use the same 28-pin socket as the Teensy 4.0, but the additional pins are unconnected and overhang the socket. It is recommended to use the T4 Breakout Board to access these pins.

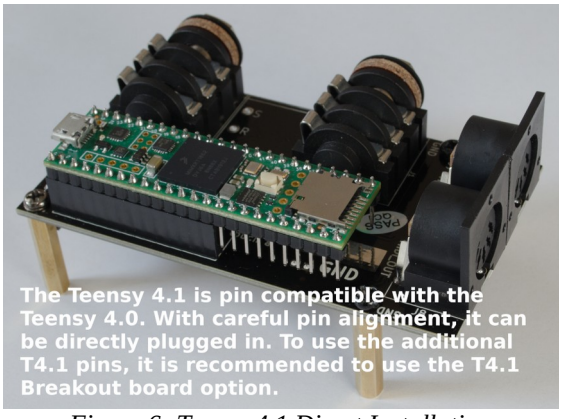


Figure 6: Teensy 4.1 Direct Installation

Operating Instructions

WARNING:

The TGA Pro contains electro-static-discharge (ESD) sensitive components, as does the Teensy when installed. Avoid directly touching the electronic components on the board whenever possible. Always install and touch one of the metal standoffs while handling the board.

TIPS FOR OPTIMAL AUDIO QUALITY

The TGA Pro is carefully designed to prevent digital signals from the Teensy and TGA Pro digital circuits from coupling into the sensitive analog circuits and appearing as noise or interference in your audio.

However, it is not always easy to prevent ground noise ***from other equipment*** from getting into the audio analog signals and ground. This often happens through ground loops caused by the common ground in household wiring.

The following tips can be used to reduce interference in audio equipment using unbalanced signals such as guitar pedals, amps and the TGA Pro.

- Plug all audio gear into the same outlet/power bar as the computer providing the USB connection to your Teensy. Using different wall outlets for the computer and your audio gear can create large ground loops in the household wiring.
- When programming/debugging your Teensy programs, connect the Teensy to the PC or laptop host. Once programmed, powering the Teensy with a micro-USB cellphone charger can greatly reduce ground noise caused by computers with particularly noisy USB connections.
- If using a laptop with your Teensy, disconnect the laptop battery charger and run the laptop on it’s own battery. This may also reduce ground loops within the household wiring.

Some computers have extremely noisy USB interfaces. If powering the Teensy with a micro-USB charger makes most the noise go away, you may want to try a different computer or laptop. One with higher quality USB ports may provide significantly lower noise.

Converting the Teensy USB for external power can also be used to prevent noise. See the PJRC website for information on how to supply power to the VIN pin on the Teensy.

Software

The BALibrary is used to control and configure the TGA Pro can be downloaded from:

https://github.com/Blackaddr/BALibrary

Using your TGA Pro

If you are not using the Expansion Board, it is recommended to install the standoffs such that the ESD sensitive components are hidden underneath. This makes handling easier when inserting and removing plugs.

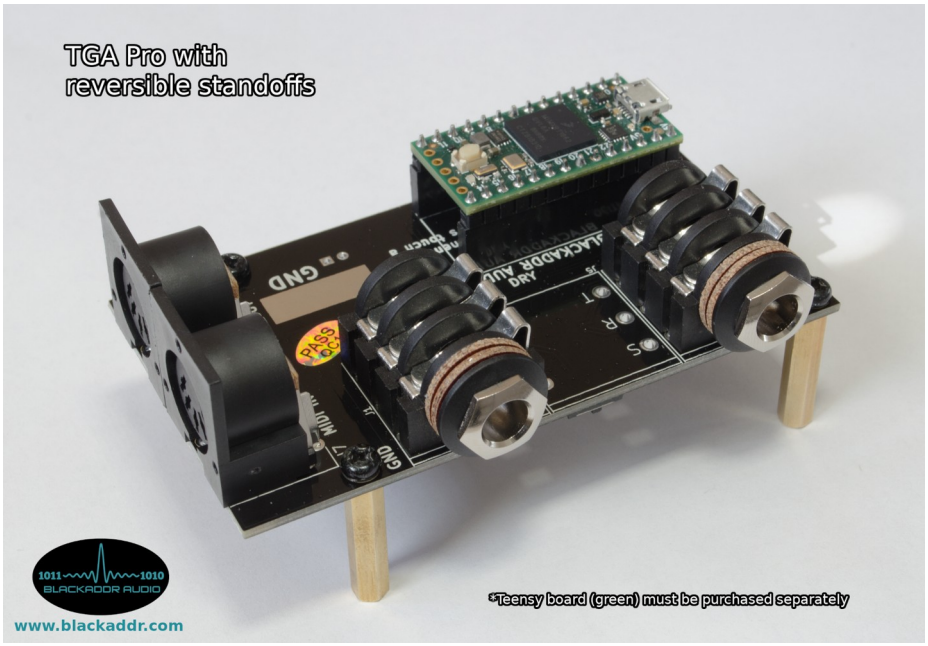


Figure 7: Reverse Standoff Installation

*** In order to have full control over the TGA Pro, install the BALibrary by downloading it from the Github link and installing it into your Arudino IDE as an ‘additional Library’ by importing the ZIP file.

https://www.arduino.cc/en/Guide/Libraries

https://github.com/Blackaddr/BALibrary/archive/master.zip

1. Insert the Teensy PCB as shown previously in this User Guide.

2. Plug a USB cable into the Teensy PCB.

3. Plug the other end of the USB into your computer.

4. Launch the Arduino IDE program. If you installed the BALibrary you can access the provided examples from with the IDE. Additional Libraries will be found at the very bottom of the list.

Your First Program – Hello Audio World!

It is recommended to try as your first program *BALibrary/Examples/Basic/BA0_HelloAudioWorld.ino*. This is a minimal sketch illustrating the bare minimum required to pass audio through the TGA Pro.

You can use this as a building block for creating your own programs. The mono input audio is passed directly to the both outputs of the stereo jack in case you are using headphones, but you can also just plug into your amp.

Your Second Program – Delay and Reverb

BALibrary/Examples/Basic/BA1_DelayAndReverb.ino

This second program is also a simple Arduino sketch that uses a few very basic components in the PJRC Teensy Audio Library to add a delay and reverb effect to your guitar. This is a great starting point to learn how audio effects are chained and routed with Teensy Audio before moving on to studying the more complex, MIDI capable effects in the BALibrary.

Note: the basic PJRC delay and reverb in this sketch are meant to be simple effects that act as learning aids. There are much better sounding pro-quality effects available to you in BALibrary and from others in the community. Keep an eye on the Teensy Audio Sub-forum for others sharing their work!

Advanced Effects

Several more advanced effect programs with both physical control via the Expansion Control Board or MIDI are available in the other example sub-folders. Depending on how you want to control the parameters of your effects, these demos may provide good references for your own programs.

Installing the Teensy PCB onto the TGA Pro

Get to know your TGA Pro before installing a Teensy board.

Install your Teensy microcontroller board into the socket. The Teensy board must have square shaped, 0.1” male pins to insert correctly. It is very important to make sure the Teensy PCB is aligned correctly. **Failure to align the pins correctly (accidentally shifted to the right or the left) can cause permanent damage to both the Teensy PCB and the TGA Pro**. Refer to the photos in the Compatibility section for correct orientation.

TGA Pro Legend

Get to know your TGA Pro!

1. Audio Input
2. Dry Output (optional add-on)
3. Audio Output
4. Preamp Gain Switch
5. MIDI Input
6. MIDI Output
7. LEDs
8. J2 Expansion Header

9. J6 Test-point Header

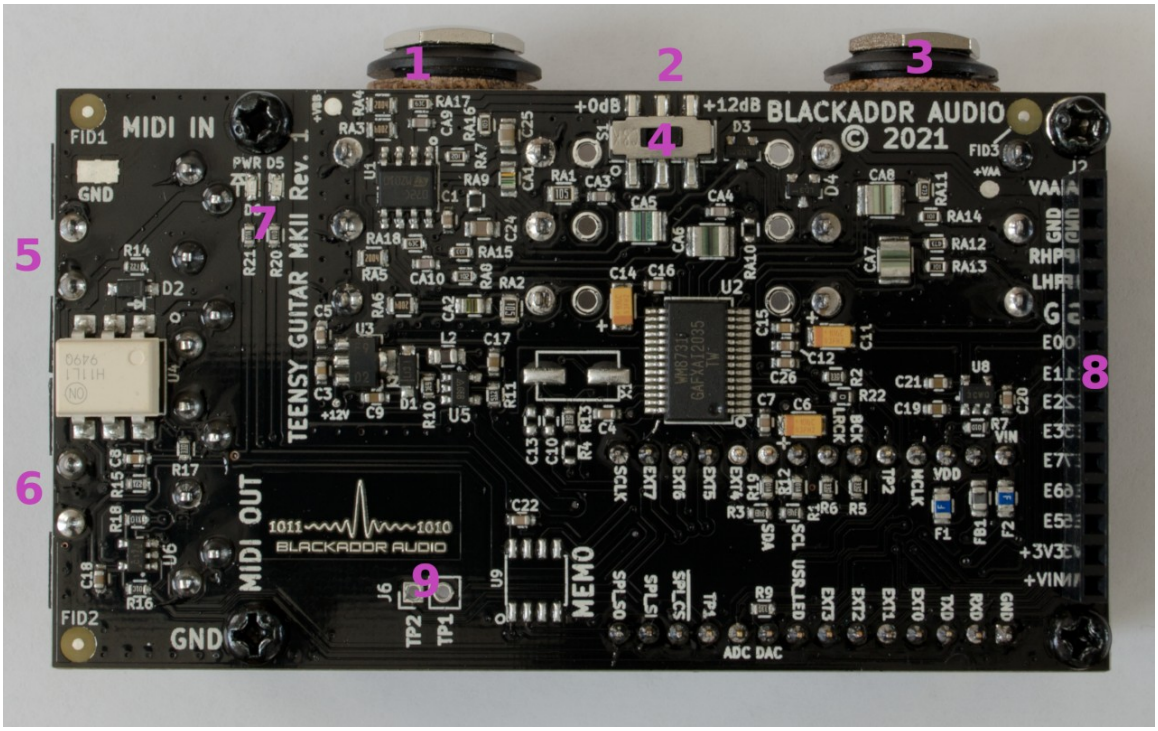


Figure 8: Component Side Features

1. Audio Input

Stereo TRS, unbalanced input. Plug your guitar in to this jack. Also will work with line-level sources. When no plug is inserted, both channel inputs are grounded automatically.

Input impedance: ~ 1M

Voltage Max: 9V peak-to-peak

2. Dry Output - Instrument (optional add-on)

Stereo TRS, unbalanced output. This is the output of the stereo analog preamp before going to the CODEC, but after the first-stage anti-aliasing filter. The preamp is is powered by +9V, just like a guitar pedal, and is capable of achieving approximately 6 Vpp. *This output is safe to drive guitar pedals and guitar amps, but should only be connected to line-level inputs if a line-level device is connected to the Audio Input jack.*

Output impedance: ~ 1K

Voltage Range: ~6V peak-to-peak maximum

3. Audio Output

Stereo TRS, unbalanced output. This is the analog output of the stereo codec's digital-to-analog converter (DAC). It is suitable to drive line-level, guitar pedal, or guitar amp inputs.

Output impedance: ~100 Ohm

Voltage Range: 1.0V RMS

4. Preamp Gain Switch

This switch selects the gain of the high-impedance preamp. Preamp gain is either 0dB (unity) or +12dB gain.

5. MIDI Input

This jack is a MIDI compliant 5-pin jack. The on-board MIDI circuit converts MIDI signals to the correct levels to be received by the Teensy UART. The Teensy software library has built-in MIDI support though this port. See the BALibrary demos for more details.

6. MIDI Output

This jack is operated at 3.3V, and is designed to be compliant with MIDI outputs using this voltage level. It is safe to connect to any MIDI input, regardless of whether that circuit operates at 3.3V (modern) or 5V (vintage). The MIDI output circuit is driven by the Teensy UART. The Teensy software library has built-in MIDI support through this port. See the BALibrary demos for more details.

7. LEDs

Two LEDs are installed on the TGA Pro. One is BLUE, and will illuminate whenever 3.3V power is received from the Teensy board. The other is GREEN, and is user controllable by software running the Teensy. See the TGA Pro schematic, and BALibrary for more details.

8. J2 Expansion Header

Contains

- stereo headphone outputs.
- 4 digital-only I/O pins from the Teensy. Useful for connecting switches and LEDs.
- 3 analog ADC capable I/O pins from the Teensy. Teensy ADC can be used for reading POTs or as digital I/O.

This header is used by the Expansion Board to provide several pushbutton switches, POTs and LEDs.

9. J6 Test-point Header

Contains two additional controllable digital I/O pins from the Teensy. See the TGA Pro Schematic for details. These pins operate at 3.3V. Very useful for debugging outputs when the Expansion Board is already using up all the pins on J2. Otherwise, two more I/O for your project's switches or LEDs!

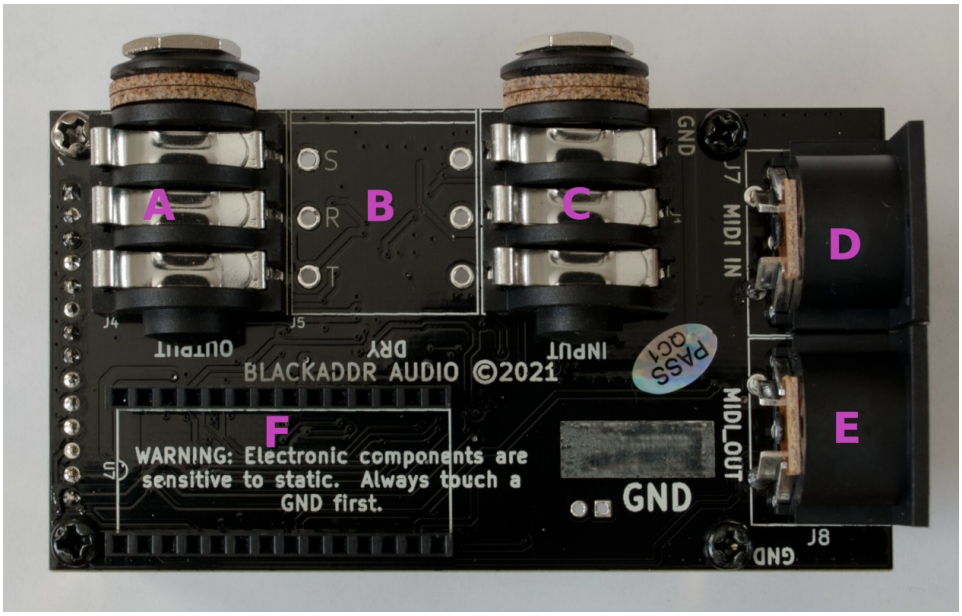


Figure 9: Connector Side Features

A. Audio Input ¼" TRS

B. Dry Output ¼" TRS (optional add-on)

C. Audio Output ¼" TRS

D. MIDI Input

E. MIDI Output

F. Teensy Socket

F. TEENSY SOCKET

Install your Teensy microcontroller board in this socket. The board must have square shaped, 0.1" male pins to insert correctly. It is very important to make sure the Teensy PCB is aligned correctly. Failure to

align the pins correctly (accidentally shifted to the right or the left) can cause permanent damage to both the Teensy PCB and the TGA Pro. Use the images in the Compatibility section as guidelines.

Help & Troubleshooting

Help with the Arduino IDE and Teensy PCB programming can be obtained from the PJRC Forums.

https://forum.pjrc.com/

For questions about the BALibrary, or the TGA Pro board, use the contact at the end of this document.

Hardware Testing

The test program used to ensure your product is manufactured and assembled correctly is also provided so you can ensure your product is physically working correctly. Be sure after uploading the test program to the Teensy you open the Arduino Serial Monitor from the IDE in order to see the test results.

The test program is located at the following path in the BALibrary:
BALibrary/Examples/Tests/TGA_PRO_Basic_Test/TGA_PRO_Basic_Test.ino

Before compiling and uploading this program, be sure it is configured correctly. Near the top of the program, just after the comment header is the following:

```
//#define RUN_MIDI_TEST // Uncomment this line to run a MIDI test. You must connect a MIDI cable as a loopback between the MIDI input and output jacks.
//#define RUN_MEMO_TEST // Uncomment this line if you purchased the option SPI RAM.
//#define RUN_EXP_TEST  // Uncomment if you purchased the Expansion Control Board
```

By default, the program will only run an audio pass-through test. To enable the optional tests you must uncomment the above lines. The optional tests run first, then the audio codec is configured for the standard testing.

You must also ensure the program is configured for the correct hardware revision by ensuring the correct line is uncommented in the setup() function

```
  TGA_PRO_MKII_REV1(); // Declare the version of the TGA Pro you are using.
  //TGA_PRO_REVB(x);
  //TGA_PRO_REVA(x);
```

Audio Pass-thru / Standard Test

Connect an audio source to the INPUT jack and connect the OUTPUT to an amplifier. Once the codec is initialized, you should get pass-thru audio. You will also see the user LED on the board next to the power LED blinking on and off about once per second.

MIDI Test (Optional)

For the MIDI test you must connect a MIDI cable between the MIDI INPUT and MIDI OUTPUT. If you uncomment the `#define RUN_MIDI TEST` the program on startup will run a loopback speed test to ensure MIDI circuitry is working correctly. The tests will not complete if a MIDI cable is not connected.

Memory Test (Optional)

If you ordered the optional SPI RAM chip, you can run a test to ensure it is working correctly. You must take two steps enable this test correctly. First, you uncomment the `#define RUN_MEM0_TEST`, then you must also ensure the memory size has been set correctly. TGA Pro MKII Rev1 boards shipped in 2021 or earlier have 4M memory, those shipped in 2022 and onwards have 64M memory.

```
#if defined(RUN_MEMO_TEST)
  SPI_MEM0_64M();   // declare the 64Mbit optional PSI memory
  //SPI_MEM0_4M();  // previous models came with 4M or 1M
  // SPI_MEM0_1M();
  spiMem0.begin(); delay(10);
  if (spiTest(&spiMem0, 0)) { Serial.println("SPI0 testing PASSED!");}
#endif
```

While the test is running, dots (.) will be printed in the terminal. If an error is encountered the memory test will report error, otherwise it will report PASSED.

Expansion Board Test (Optional)

If you ordered the optional Expansion Control Board, you can run a test to ensure it is working correctly. To enable this test, uncomment the `#define RUN_EXP_TEST`. Enabling this test will result in the following behaviour:

- pressing one of the buttons on the Expansion Control Board will cause the corresponding LED to light up when the button is held down. Text will also be printed in the Arduino serial monitor when a button push is detected.
- When turning turning the pots, the value for the given pot will be displayed in the Arduino serial monitor as a value between 0.0 and 1.0. Sweep each pot through it’s full range to ensure it can go all the way to 0.0 and to 1.0.
- When adjusting any of the pots, the pot will control the headphone volume. Connect headphones to the 1/8” jack on the expansion board and turn one of the knobs to confirm audio volume in the headphones is changing (this requires you provide a sound input at the INPUT jack on the TGA Pro.

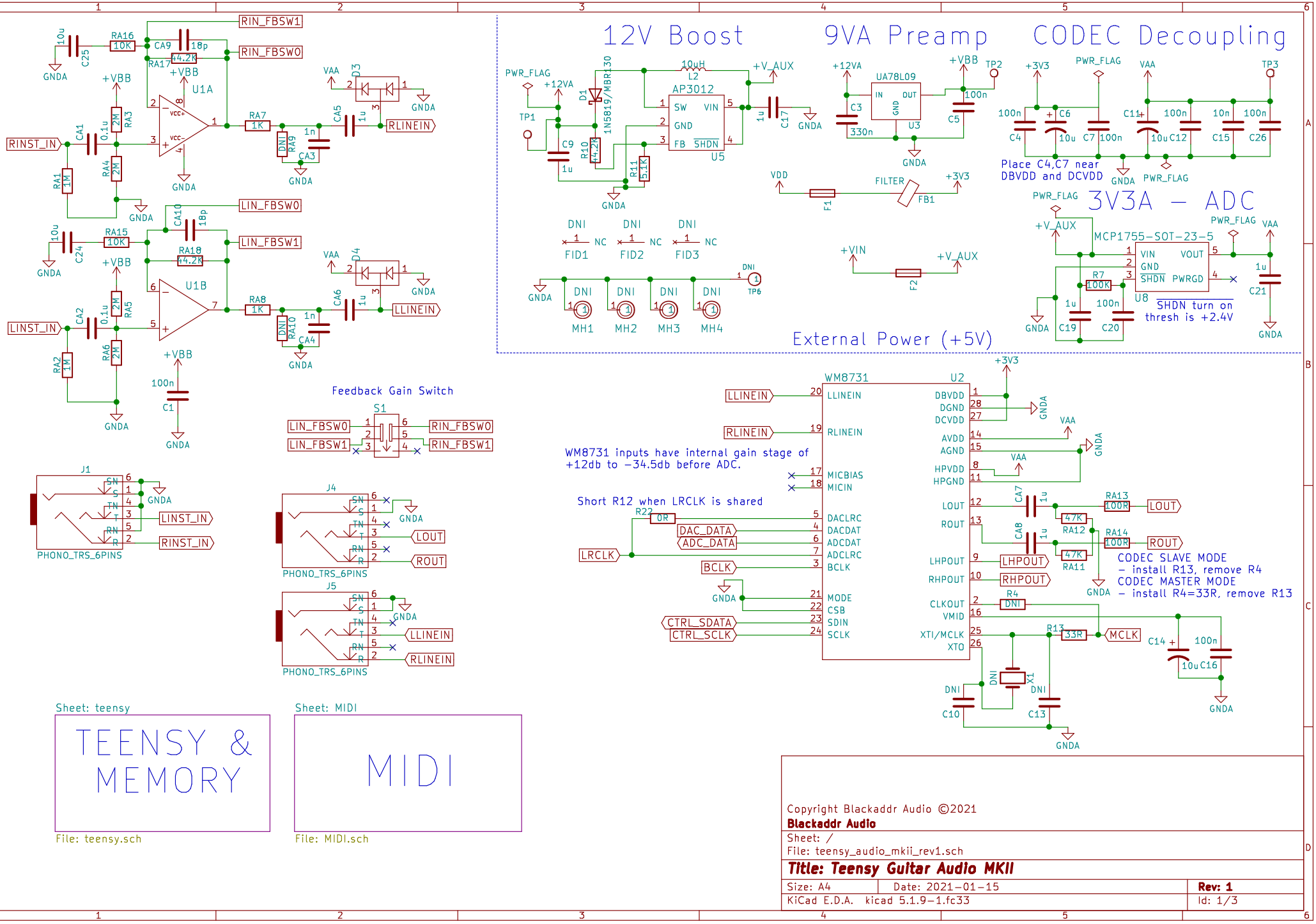
Eratta

None at this time.

Contact

Blackaddr Audio

steve@blackaddr.com


12V Boost
9VA Preamp
CODEC Decoupling
3V3A – ADC
External Power (+5V)
Feedback Gain Switch
WM8731 inputs have internal gain stage of +12db to −34.5db before ADC.
Short R12 when LRCLK is shared
CODEC SLAVE MODE
– install R13, remove R4
CODEC MASTER MODE
– install R4=33R, remove R13
Place C4,C7 near DBVDD and DCVDD
SHDN turn on thresh is +2.4V
Sheet: teensy
TEENSY & MEMORY
File: teensy.sch
Sheet: MIDI
MIDI
File: MIDI.sch
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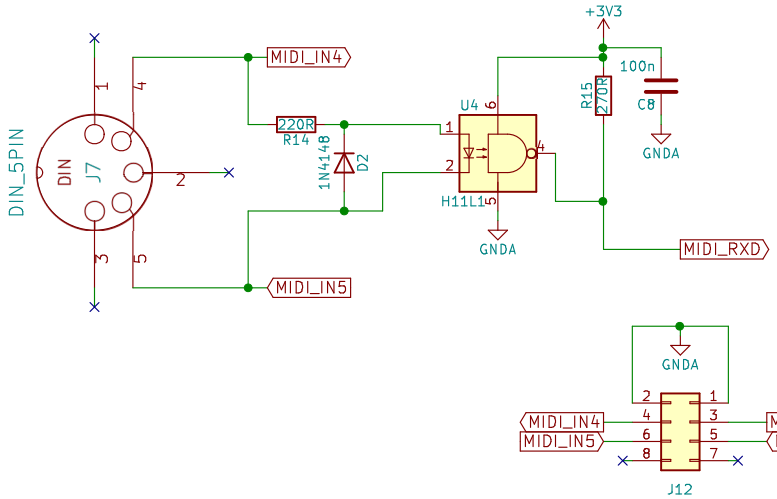
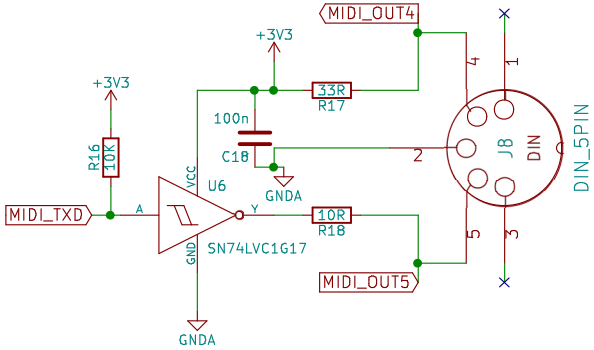
Blackaddr Audio
Sheet: /
File: teensy_audio_mkii_rev1.sch
Title: Teensy Guitar Audio MKII
Size: A4
Date: 2021-01-15
Rev: 1
KiCad E.D.A. kicad 5.1.9-1.fc33
Id: 1/3

MIDI_IN



MIDI_OUT



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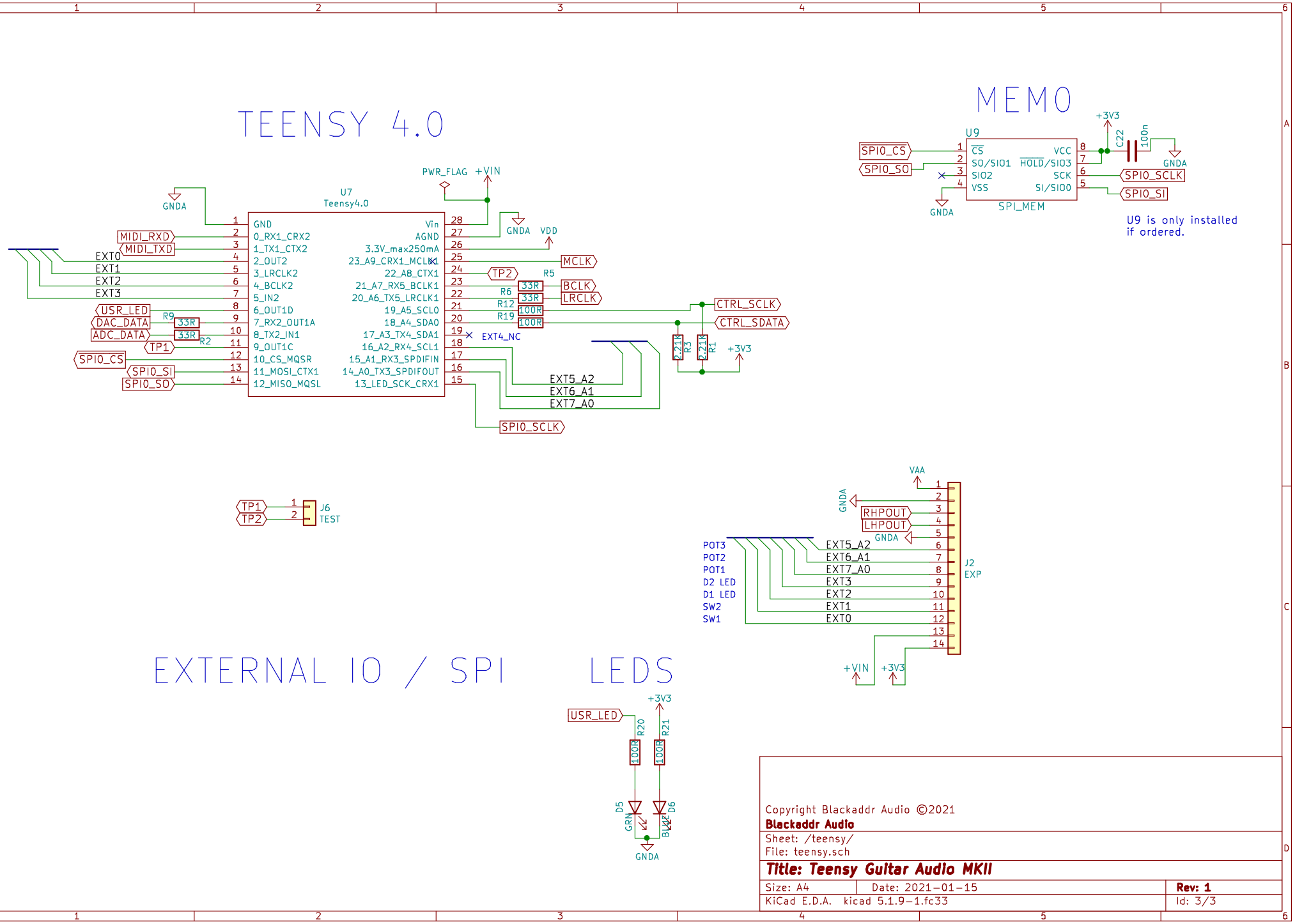
Sheet: /MIDI/
File: MIDI.sch

Title: Teensy Guitar Audio MKII

Size: A4	Date: 2021-01-15	**Rev: 1**
KiCad E.D.A. kicad 5.1.9-1.fc33		Id: 2/3



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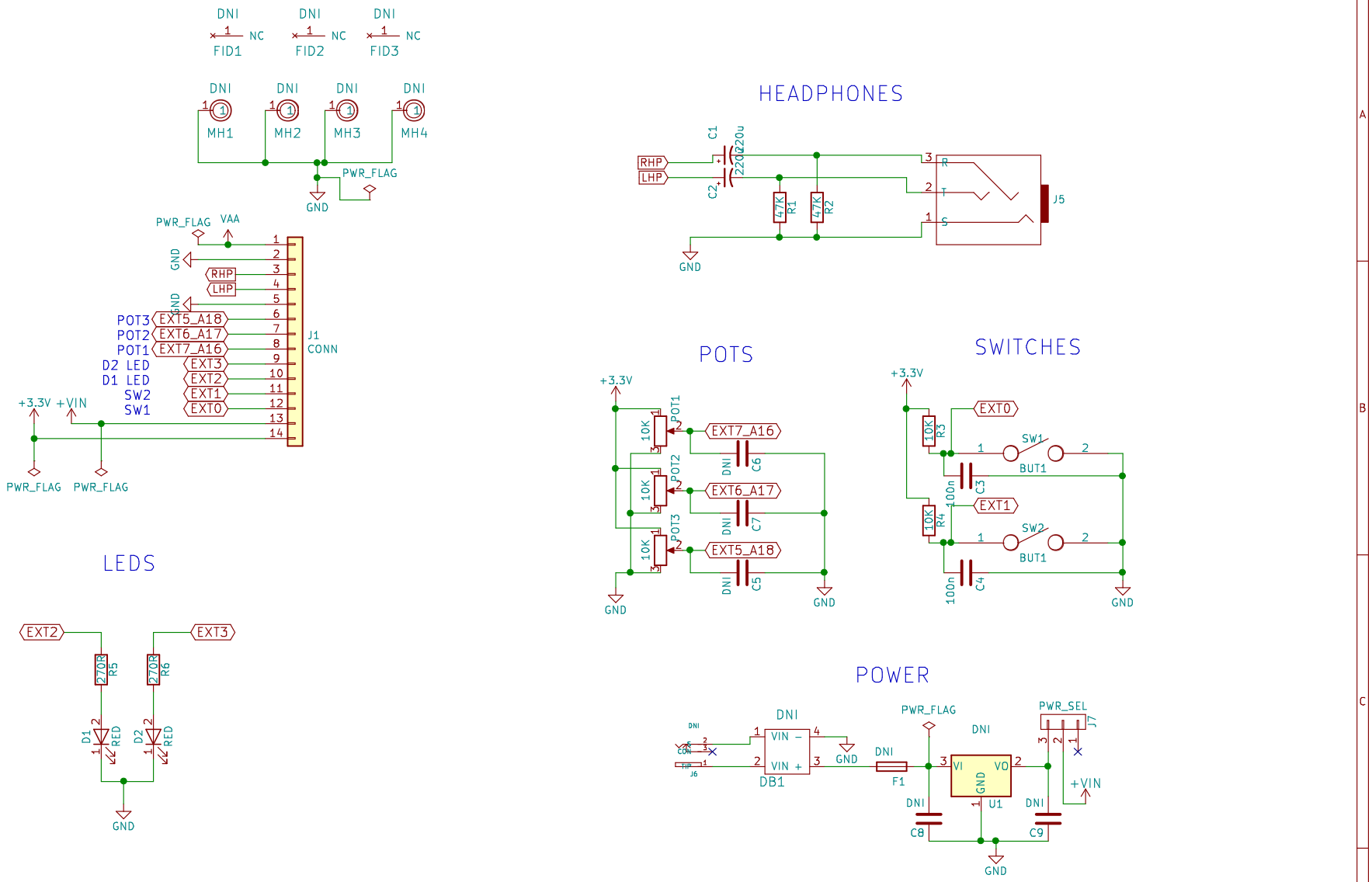
Sheet: /teensy/

File: teensy.sch

Title: Teensy Guitar Audio MKII

Size: A4	Date: 2021-01-15	**Rev: 1**
KiCad E.D.A. kicad 5.1.9-1.fc33		Id: 3/3



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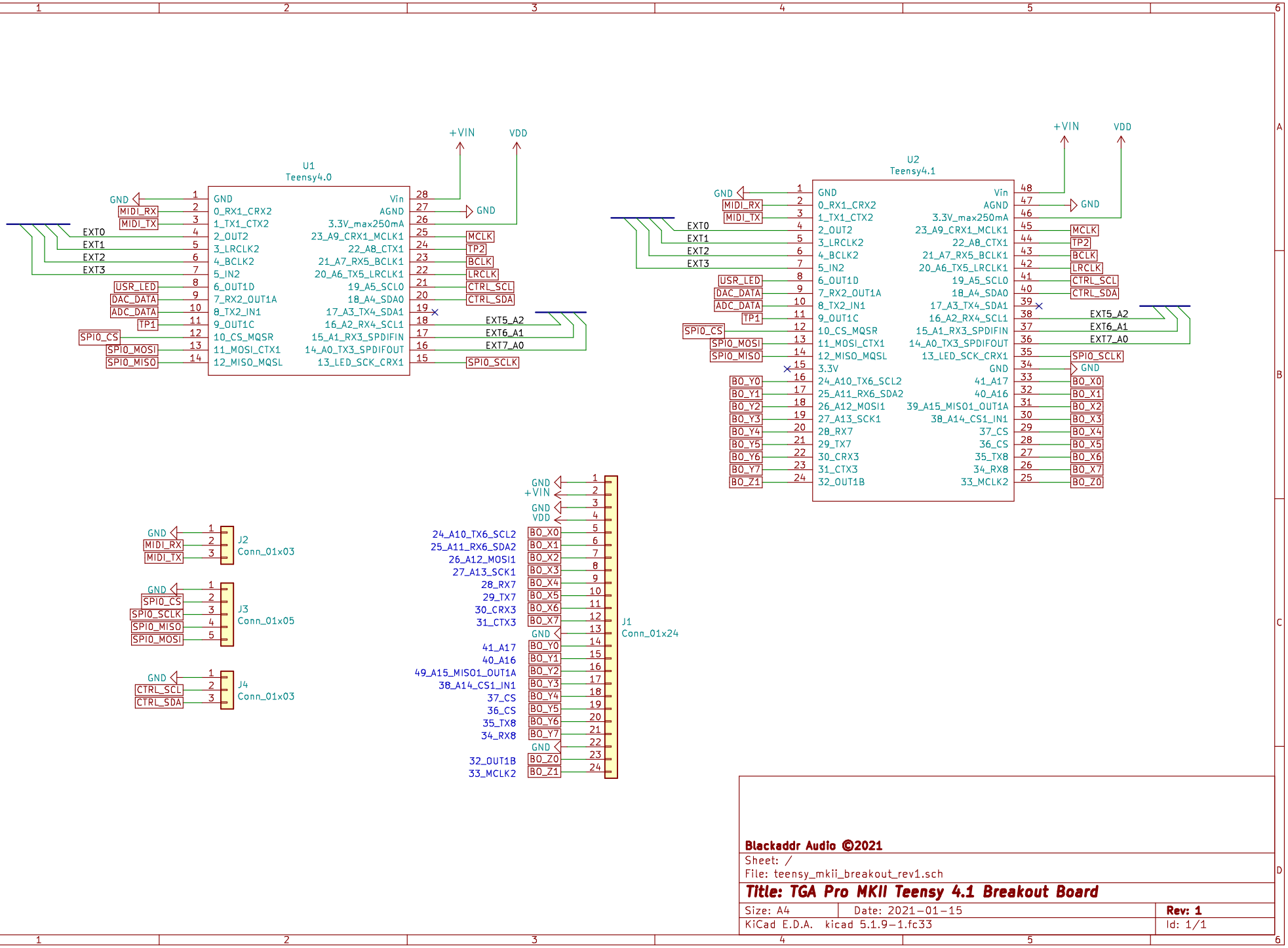
Sheet: /
File: teensy_audio_exp_rev3.sch

Title: Teensy Audio Expansion

Size: A4	Date: 2020-10-07	**Rev: 3**
KiCad E.D.A. kicad 5.1.9-1.fc33		Id: 1/1


U1
Teensy4.0
GND
0_RX1_CRX2
1_TX1_CTX2
2_OUT2
3_LRCLK2
4_BCLK2
5_IN2
6_OUT1D
7_RX2_OUT1A
8_TX2_IN1
9_OUT1C
10_CS_MQSR
11_MOSI_CTX1
12_MISO_MQSL
Vin
AGND
3.3V_max250mA
23_A9_CRX1_MCLK1
22_A8_CTX1
21_A7_RX5_BCLK1
20_A6_TX5_LRCLK1
19_A5_SCL0
18_A4_SDA0
17_A3_TX4_SDA1
16_A2_RX4_SCL1
15_A1_RX3_SPDIFIN
14_A0_TX3_SPDIFOUT
13_LED_SCK_CRX1
+VIN
VDD
MIDI_RX
MIDI_TX
EXT0
EXT1
EXT2
EXT3
USR_LED
DAC_DATA
ADC_DATA
TP1
SPI0_CS
SPI0_MOSI
SPI0_MISO
MCLK
TP2
BCLK
LRCLK
CTRL_SCL
CTRL_SDA
EXT5_A2
EXT6_A1
EXT7_A0
SPI0_SCLK
U2
Teensy4.1
BO_Y0
BO_Y1
BO_Y2
BO_Y3
BO_Y4
BO_Y5
BO_Y6
BO_Y7
BO_Z1
BO_X0
BO_X1
BO_X2
BO_X3
BO_X4
BO_X5
BO_X6
BO_X7
BO_Z0
J2
Conn_01x03
J3
Conn_01x05
J4
Conn_01x03
J1
Conn_01x24
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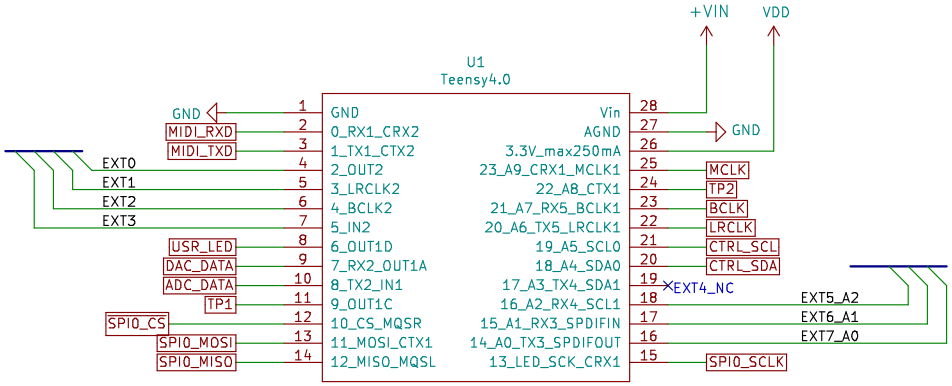
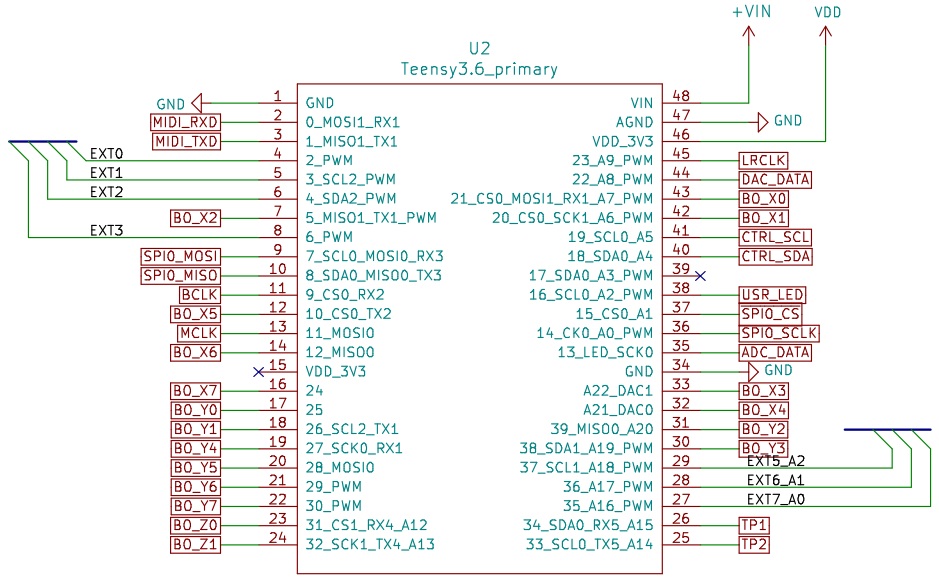
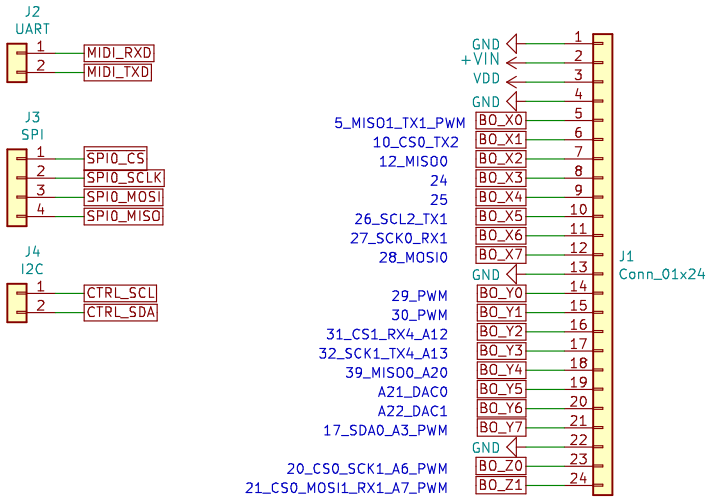
Sheet: /
File: teensy_mkii_breakout_rev1.sch
Title: TGA Pro MKII Teensy 4.1 Breakout Board
Size: A4
Date: 2021-01-15
Rev: 1
KiCad E.D.A. kicad 5.1.9-1.fc33
Id: 1/1



The T4 footprint plugs directly into the TGA Pro MKII board



The T3.X footprint is a socket for the user to plug their Teensy device into



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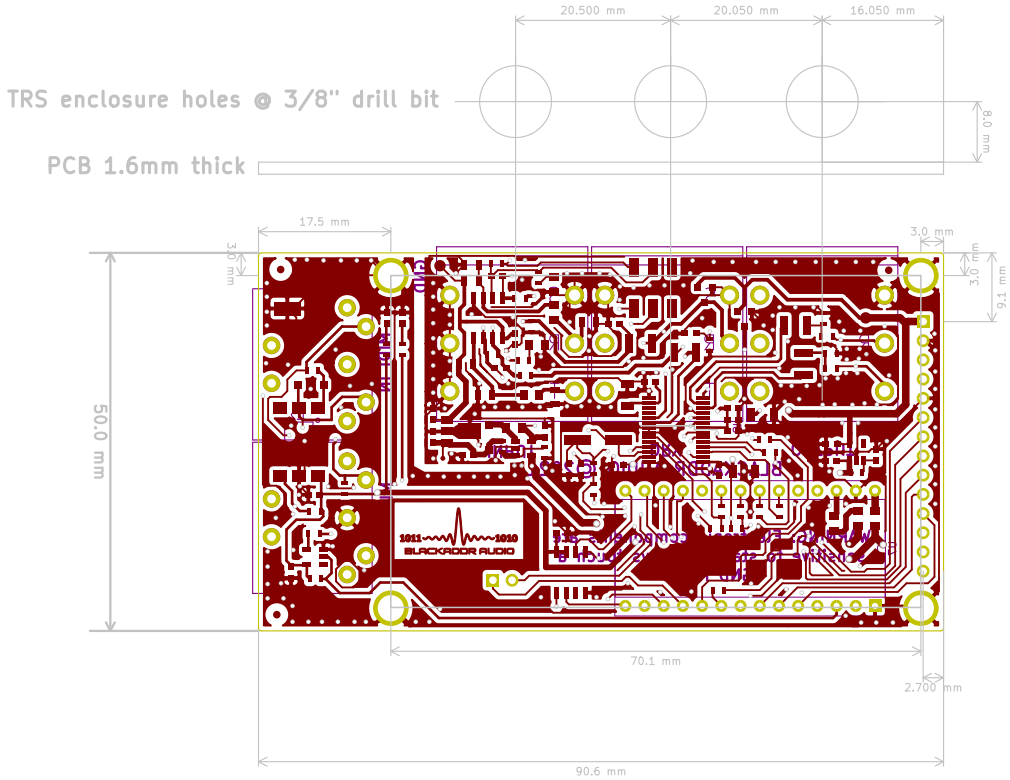
Sheet: /
File: teensy_adapter_t3.sch

Title: TGA PRO MKII Teensy 3.X Adapter

Size: A4	Date: 2021-01-02	**Rev: 1**
KiCad E.D.A. kicad 5.1.9-1.fc33		Id: 1/1

TGA Pro MKII Rev 1
Mechanical and Drilling Guide



*** PCB shown as viewed from component side ***

Sheet:
File: teensy_audio_mkii_rev1.kicad_pcb

Title: TGA Pro MKII Mechanical and Drilling Guide

Size: A4	Date: 2021-04-05	**Rev: 1**
KiCad E.D.A. kicad 5.1.9-1.fc33		Id: 1/1