Tactile Amplifier Shield

The ***Tactile Amplifier Shield*** is designed to connect to Arduino/MAPLE board or Olimexino-STM32. Those Arduino boards are equipped with fast 72MHz, 32-bit STM32 ARM processors.

The Tactile Amplifier Shield provides a 2-channel (10W per channel) of audio-quality amplification suitable for driving a speaker or a vibrotactile actuator outputs. The Tactile Amplifier Shield has an on-board 12-bit DAC that directly drives the power amplifier.

The protocol used to communicate between the processor and the DAC is SPI. The amplifier on board is the SSM3302 from Analog Devices supports 10W per channel. It is also possible to bridge the two outputs together to form a 20W single channel source. To simplify fine-tuning of the haptic amplification (or audio amplification), two logarithmic-tapered potentiometers are built in the shield.

For convenience, the Tactile Shield also provides 4 user-driven LEDs and two tactile switches.

1 Block Diagram

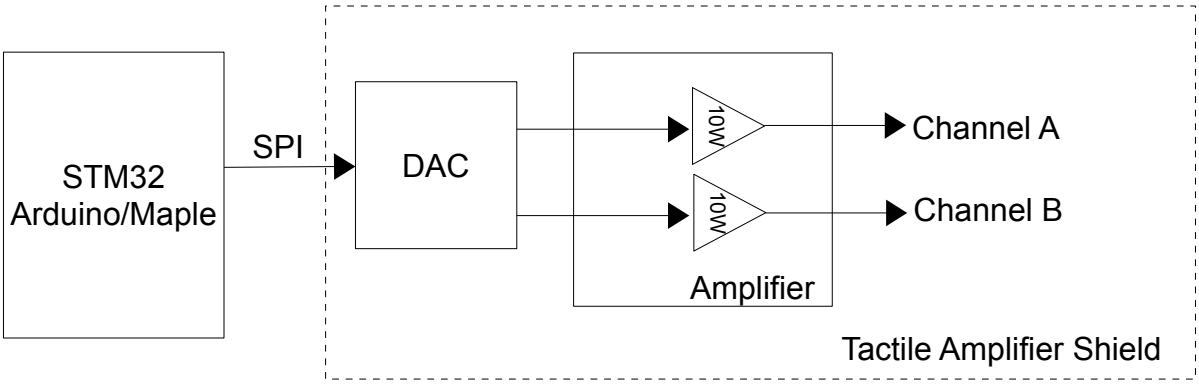


Illustration 1: Tactile Shield Block Diagram

Tel: 1 450-283-6148 Fax: 1-800-820-5789
info@tactilelabs.com www.tactilelabs.com

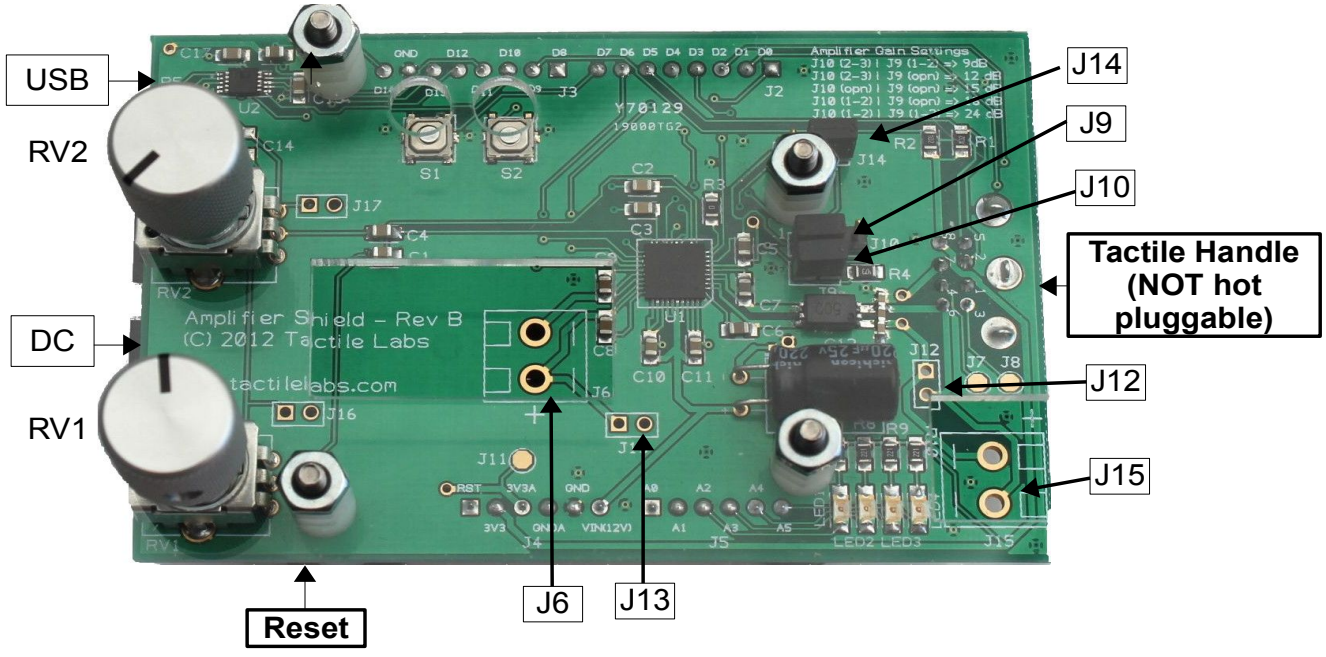
2 External Connectivity

The amplifier shield is designed to work with the *Tactile Handle* module.

CAUTION:
The handle must be connected before the power on the amplifier shield is turned on, or it may not work or even damage the sensors.

3 User IO

The amplifier shield has two output channels, and the volume of each channel is individually controllable by two potentiometers. The overall gain is determined by a set of jumpers. The IO are illustrated and described in the table below.



Part	Description
RV1	volume control for channel A
RV2	volume control for channel B
J15 and J12	channel A actuator/speaker output
J6 and J13	channel B actuator/speaker output
J9 and J10	output gain, recommended 9dB*. The detail of the gain setting is printed on the PCB.
J14	bridge mode*
Tactile Handle	Connecting to Tactile Lab's Tactile Handle
Reset (on Processor Board	Processor Reset button.
DC (on processor board	The DC power jack. +12V DC power must be provided for the amplifier to work. The recommended maximum current is 2A.
USB (on processor board)	Programming port for the processor.

4 Processor IO

The table below describes the pin assignment of the shield and the interface between the processor and the onboard DAC.

Pin	Function	Name	Description
A2	output	LED1	0 = on, 1 = off
A3	output	LED2	0 = on, 1 = off
A4	output	LED3	0 = on, 1 = off

* Please refer to the amplifier's specification for details on the way to bridge the amplifier for a 20W drive. Use at your own risk since improper connection can damage the amplifier. The audio gain jumpers can be used to further amplify the output.

Tel: 1 450-283-6148 Fax: 1-800-820-5789
info@tactilelabs.com www.tactilelabs.com

A5	output	LED4	0 = on, 1 = off
D0	input	OVR_TMP	'1' if overheating
D3	output	nSHDL	channel A, 0 = shutdown, 1 = enabled
D4	output	RegEn	set to '1' to enable internal regulator must be set to operate the amplifier.
D6	output	nSHDR	channel B, 0 = shutdown, 1 = enabled
D7	output	S1	switch 1. Need to enable the internal pullup in the processor. Pressing the switch outputs '0'.
D8	output	S2	switch 2. Need to enable the internal pullup in the processor. Pressing the switch outputs '0'.
D10	SPI	SYNC	frame synchronization for the DAC frame
D11	SPI	DIN	data going to the DAC (see SPI specifications)
D12	DAC	nLDAC	set to '1' . Can be used to time-synchronize the two DAC outputs for very accurate sound / haptic correlation, for example.
D13	SPI	CLK	clock signal for the SPI bus
D14	DAC	nCLR	set to '1'. Set to '0' to drive 0V on the DAC outputs.

5 Design Integration Notes

A 10W signal going to e.g. a small Tactile Labs Haptuators can overheat and damage the Haptuator if used continuously with high-amplitude, high power-content signals (e.g. a large sine wave). Please monitor the Haptuator temperature when using this amplifier shield and keep the continuous power level delivered to the Haptuator within its specifications. You should start with the potentiometer at a lower settings and use the jumpers to limit the amplifier gain to lower levels initially.

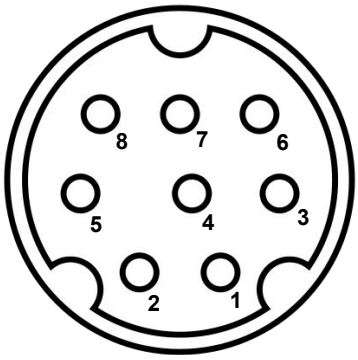
Note also that amplification levels close to the 10W limit will heat up the amplifier shield. If you use it with continuous high power, monitor the OVR_TMP pin and ensure that the amplifier does not over-heat. At high power level, the total harmonic distortion will also be higher. Keep this in mind when performing experiments. The power supply used to feed the Arduino should also be rated to support the added load of the amplifier. Driving 10W in a speaker at close proximity to a user may generate uncomfortably high sound pressure levels.

Emissions and Interference Statement

The Tactile Amplifier Shield is not an end product and cannot be considered as such from an EMI and interference generation level perspective.

As the end-user, you may be required in your jurisdiction to further filter the outputs to meet more stringent local EMI regulations. Use of this amplifier in an EMI-sensitive environment (e.g. an hospital) or near pacemakers and other sensitive electronic devices should be done with prior pre-screening of the complete system. A metal enclosure for the shield and Arduino board can be considered to reduce emissions.

6 Connector Pinout



pin	Connection
1	Ground
2	SCL (I2C)
3	CON_PIN3
4	CON_PIN4
5	SDA (I2C)
6	Amplifier OUT1
7	Amplifier OUT2
8	+3.3V

The 8-pin mini-din connector is designed to connect to Tactile Lab's Tactile Handle. Pin 6 and 7 are to be connected to the haptuator.