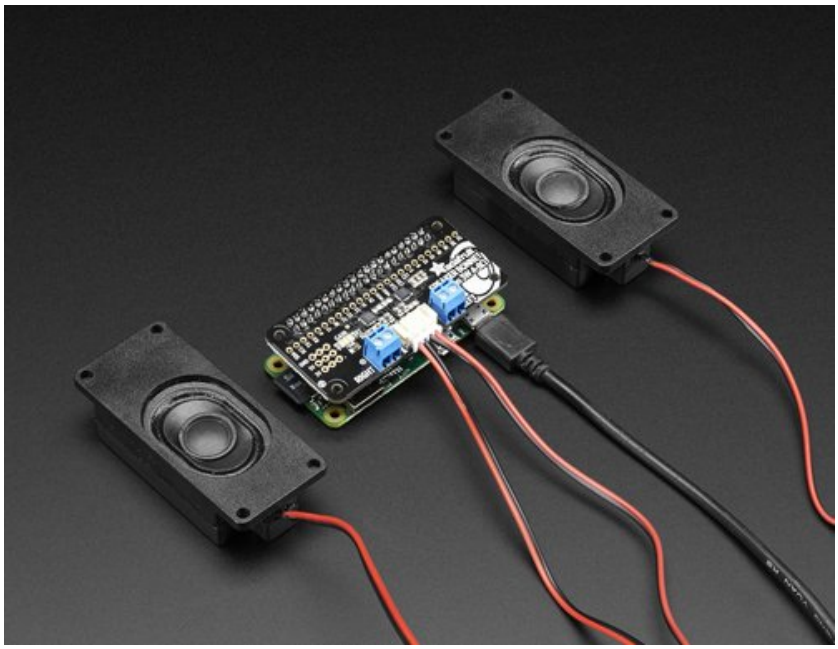
Adafruit Speaker Bonnet for Raspberry Pi

Created by lady ada



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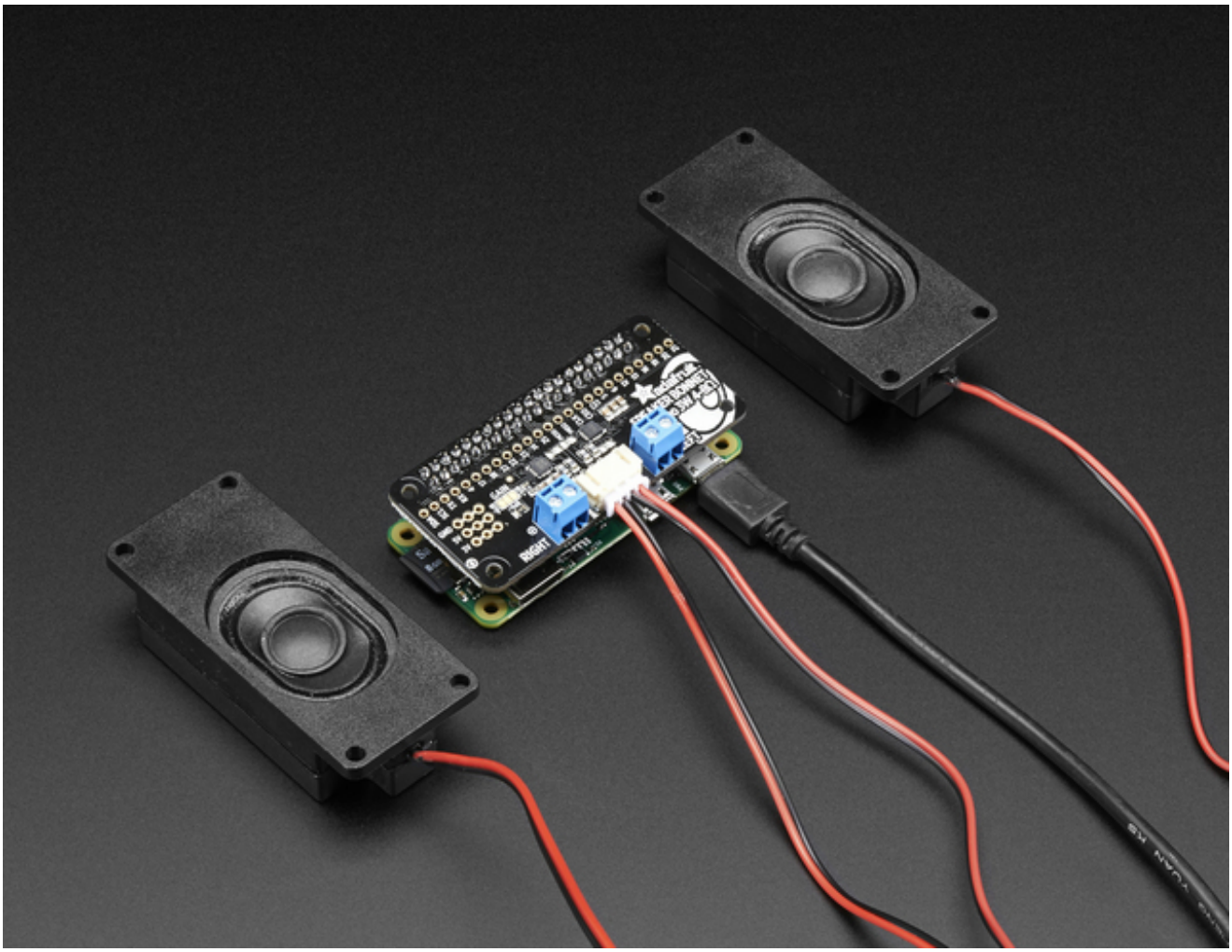
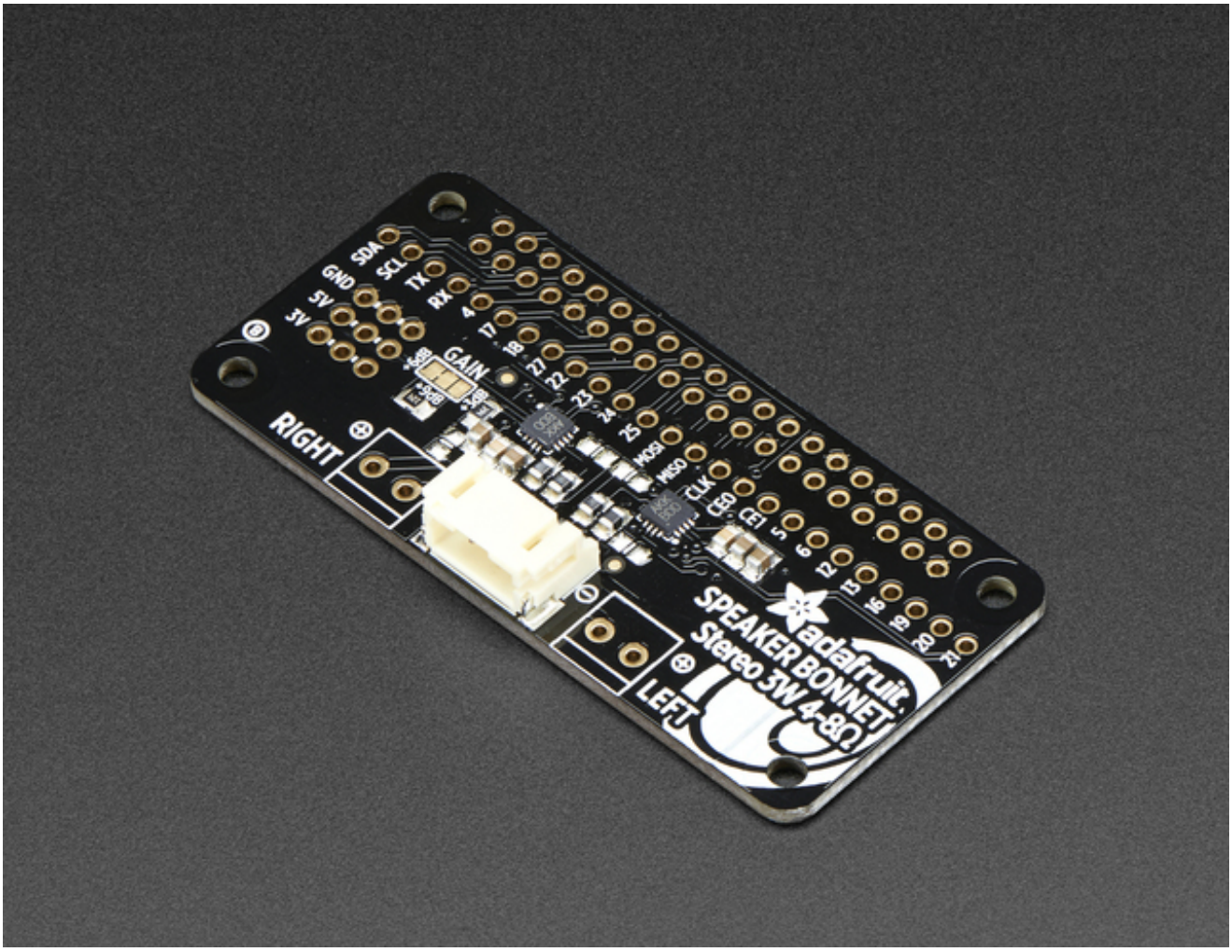
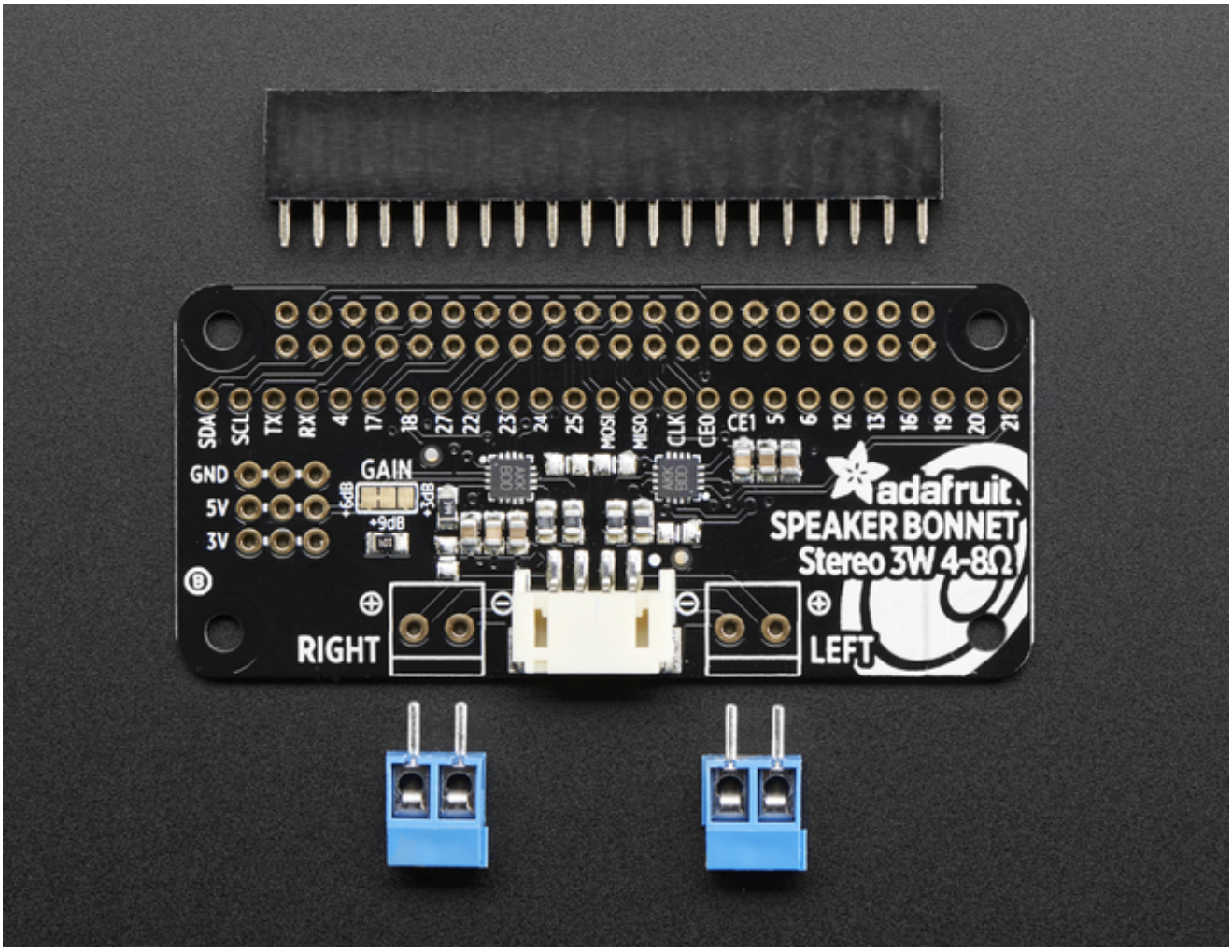
Overview



Hey Mr. DJ! Turn up that Raspberry Pi mix to the*max* with this cute 3W Stereo Amplifier Bonnet for Raspberry Pi. (It's not big enough to be an official HAT, so we called it a bonnet, you see?) It's the exact same size as a Raspberry Pi Zero but works with any and all Raspberry Pi computers with a 2x20 connector - A+, B+, Zero, Pi 2, Pi 3, etc. We've tested it out with Raspbian (the offical operating system) and Retropie.



This Bonnet uses I2S a digital sound standard, so you get really crisp audio. The digital data goes right into the amplifier so there's no static like you hear from the headphone jack. And it's super easy to get started. Just plug in any 4 to 8 ohm speakers, up to 3 Watts, run our installer script on any Raspberry Pi, reboot and you're ready to jam!

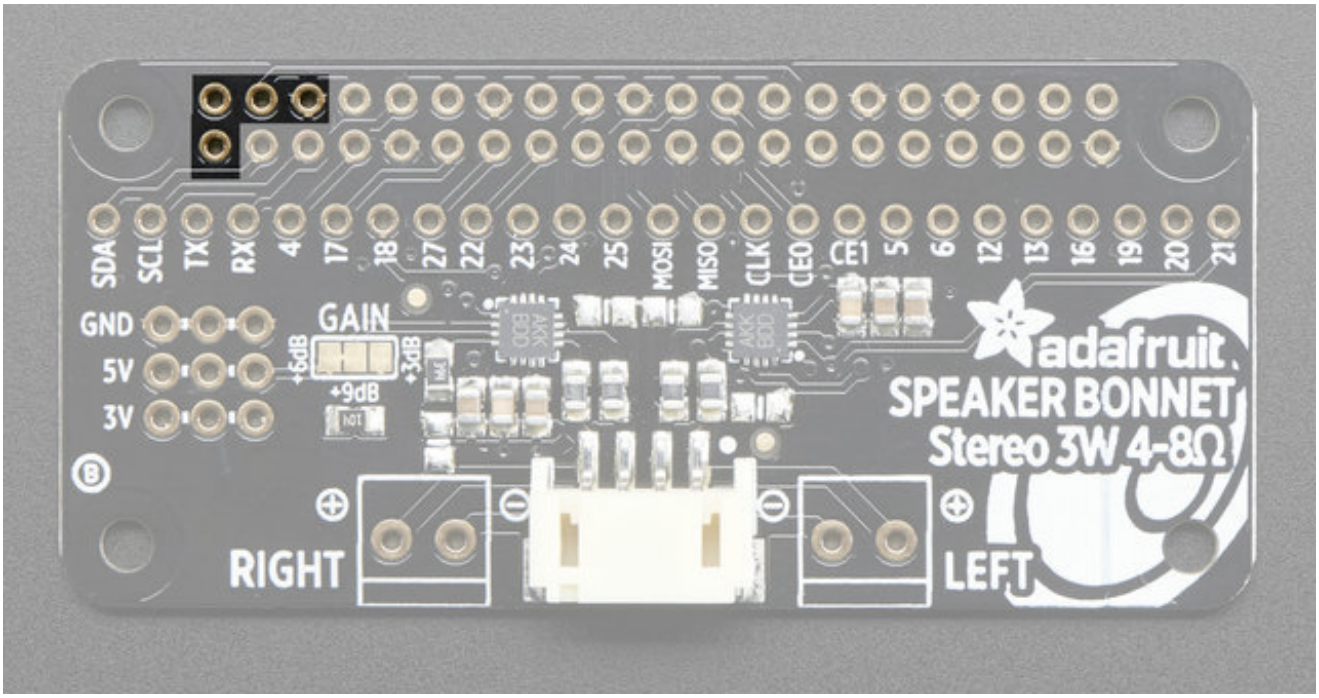


Each order comes as a fully assembled PCB with a 2x20 header and 2x terminal blocks. Some light soldering is required to attach the header onto PCB so you can plug it into your Raspberry Pi. Once that's done either plug one of our enclosed speaker sets (http://adafru.it/1669) right into the JST jack in the middle*or* you can solder the terminal blocks in and then connect any speaker you like.

Don't forget to make sure you have a good strong 5V power supply - especially if you're using the 3W 4 ohm speakers! Our 2.4A power plug is recommended (http://adafru.it/1995)

Pinouts

Power Supply



The two amplifier chips use the 3V + 5V + GND power pin at the 'top' of the 2x20 header. If using 3W speakers, you can draw a significant amount of current, over 1.5 Amps! Make sure you power your Pi with a good wall adapter like our 2.4A microUSB power plug.

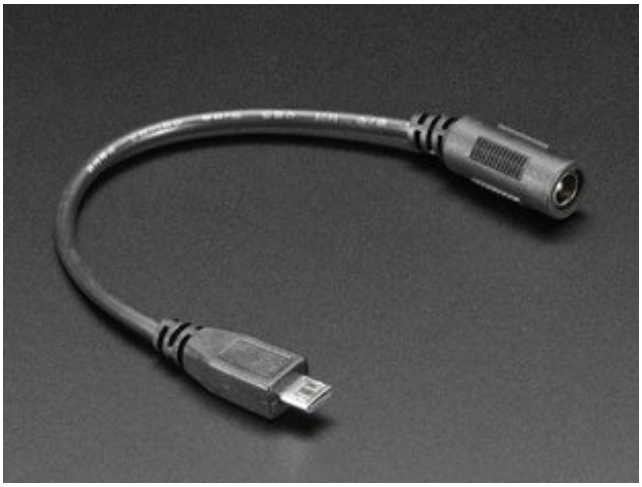
5V 2.4A Switching Power Supply with 20AWG MicroUSB Cable

PRODUCT ID: 1995
Our all-in-one 5V 2.4 Amp + MicroUSB cable power adapter is the perfect choice for powering single-board computers like Raspberry Pi, BeagleBone or anything else that's power hungry!...
http://adafru.it/e5A
$7.50
IN STOCK

Alternatively, if you *really* need a lot of power, use a 5V 4A power adapter and then a DC to micro USB adapter

5V 4A (4000mA) switching power supply - UL Listed

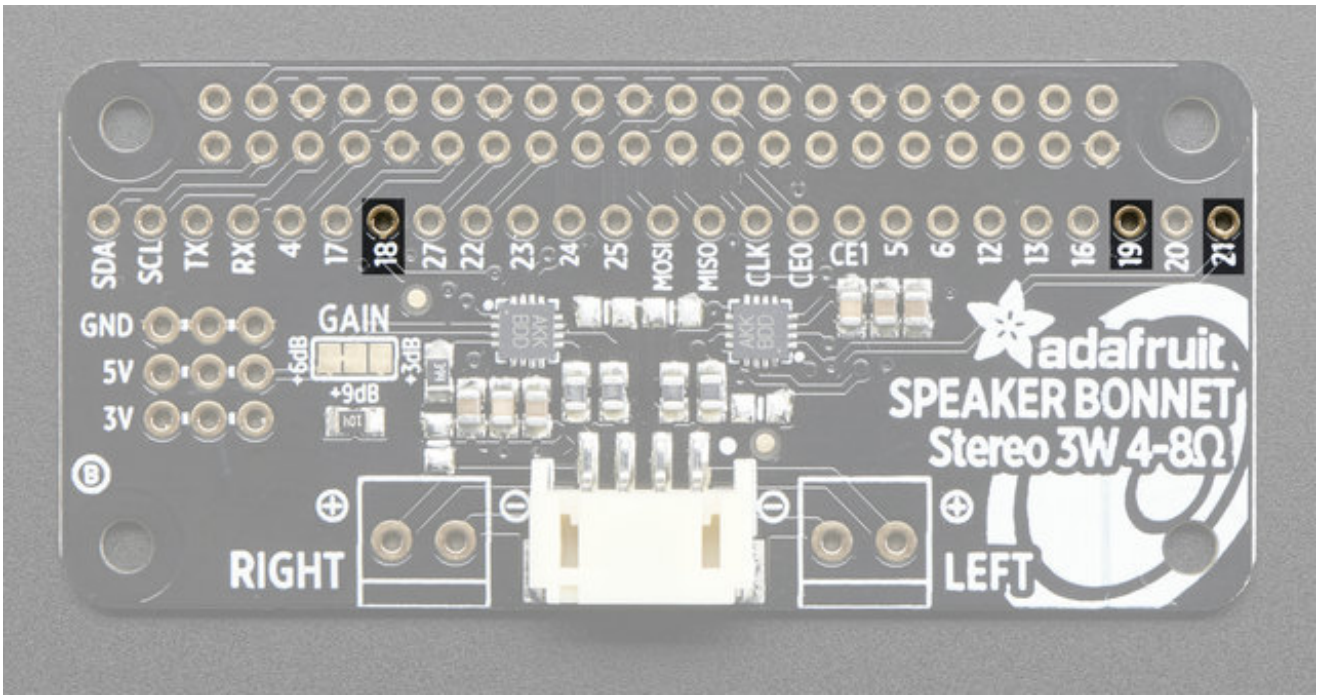
PRODUCT ID: 1466
Need a lot of 5V power? This switching supply gives a clean regulated 5V output at up to 4 Amps (4000mA). 110 or 240 input, so it works in any country. The plugs are "US 2-prong" style so...
http://adafru.it/e50
$14.95
IN STOCK



MicroUSB Plug to 5.5/2.1mm DC Barrel Jack Adapter

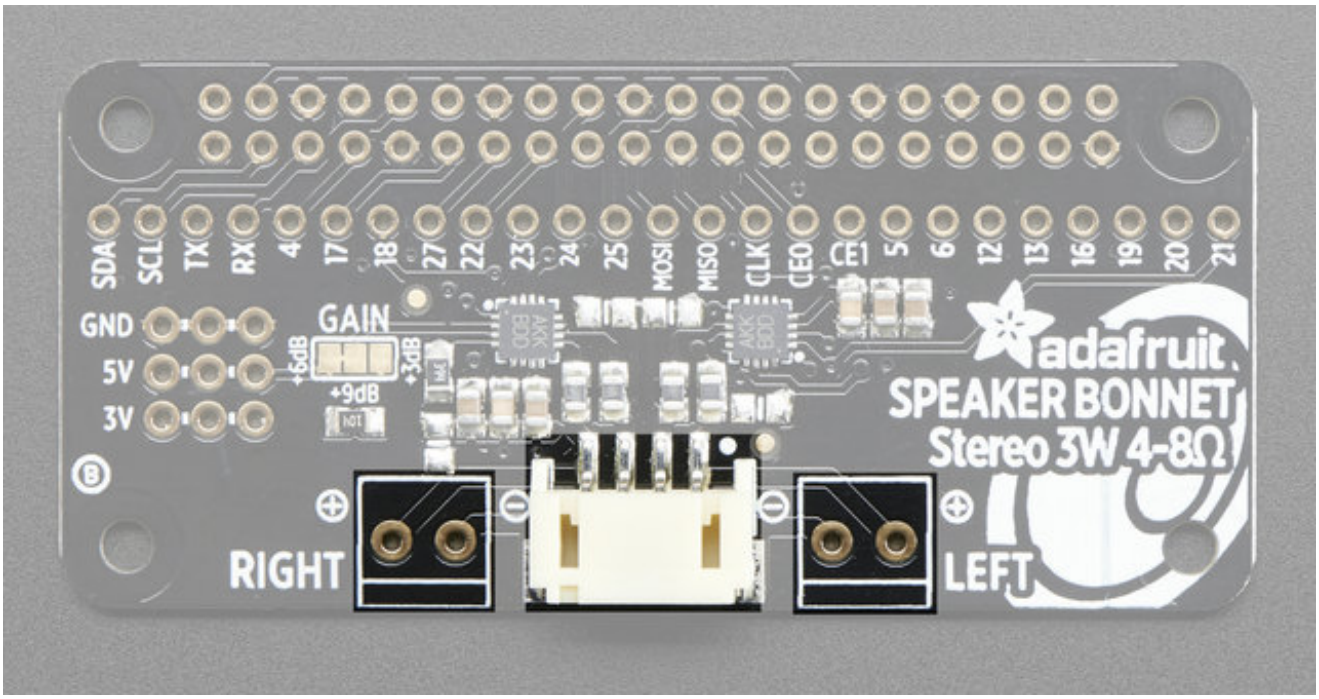
PRODUCT ID: 2727
The premise of this MicroUSB Plug to 5.5/2.1mm Jack adapter is simple. There's a MicroUSB plug on one end and a 5.5mm/2.1mm DC barrel jack with center positive polarity on...
http://adafru.it/t0F
$1.95
IN STOCK

I2S Audio Data Pins



The Bonnet uses 3 data pins **and they cannot be changed!** Pins #18, #19 and #21 are used. All other pins are available

Speaker Outputs



This is the fun part, you get stereo output - one left and one right channel. You can use the JST 4-pin plug in the center if you're going to just plug in one of our enclosed speaker kits:

Stereo Enclosed Speaker Set - 3W 4 Ohm

PRODUCT ID: 1669
Listen up! This set of two 2.8" x 1.2" speakers are the perfect addition to any audio project

where you need 4 ohm impedance and 3W or less of power. We particularly like these...
http://adafru.it/t1a
$7.50
IN STOCK

OR

You can use the terminal block spots on the left & right to connect regular speaker cones. You'll need to solder wires on and such but this way you can use whatever speaker you like! We suggest 8 ohm 1W or 4 ohm 3W. For louder audio, but more power usage, use the 4 ohm speakers. For quieter audio, but less power usage, use the 8 ohm speakers

Speaker - 3" Diameter - 4 Ohm 3 Watt

PRODUCT ID: 1314
Listen up! This 3" diameter speaker cone is the perfect addition to any audio project where you need an 4 ohm impedance and 3W or less of power. We particularly like this cone as it...
http://adafru.it/dU0
$1.95
IN STOCK

Speaker - 3" Diameter - 8 Ohm 1 Watt

PRODUCT ID: 1313
Listen up! This 3" diameter speaker cone is the perfect addition to any audio project where you need an 8 ohm impedance and 1W or less of power. We particularly like this cone as it...
http://adafru.it/t1b
$1.95
IN STOCK

You can also use other 'audio' devices like sonic transducers! These are devices you can put down onto a surface like a table, to make it into a speaker.

Medium Surface Transducer with Wires - 4 Ohm 3 Watt

PRODUCT ID: 1785
Turn any surface/wall/table etc into a speaker with a surface transducer. This type of speaker does not have a moving cone like most speakers you've seen. Instead, a small

metal rod...
http://adafru.it/t1c
$14.95
IN STOCK

Raspberry Pi Setup

At this time, Jessie Raspbery Pi kernel does not support mono audio out of the I2S interface, you can only play stereo, so any mono audio files may need conversion to stereo!

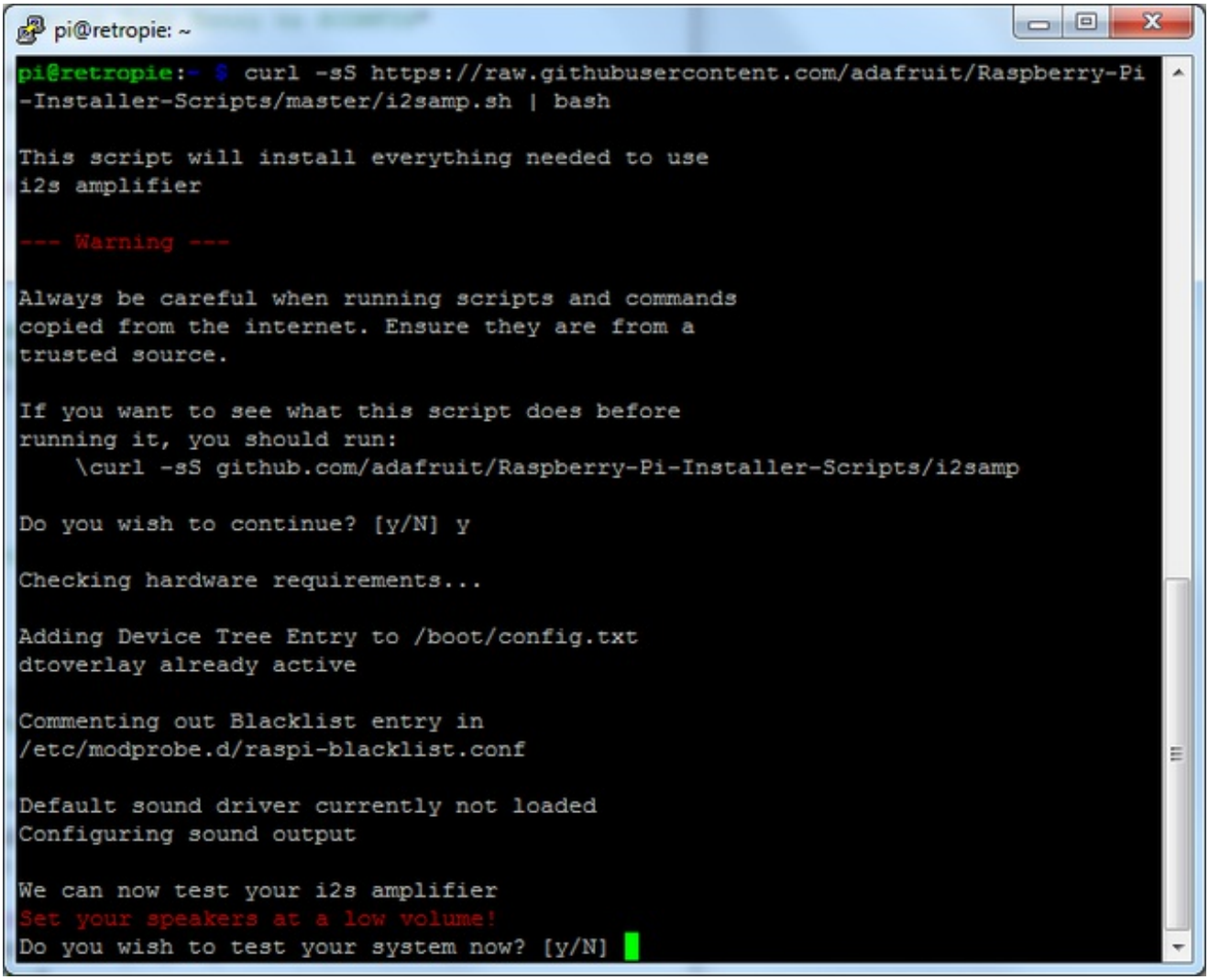
Fast Install

Luckily its quite easy to install support for I2S DACs on Raspbian Jessie.

These instructions are totally cribbed from the PhatDAC instructions at the lovely folks at Pimoroni! (http://adafru.it/nFy)

Run the following from your Raspberry Pi with Internet connectivity:

```
curl -sS https://raw.githubusercontent.com/adafruit/Raspberry-Pi-Installer-Scripts/master/i2samp.sh | bash
```



You may need to reboot once. After rebooting, log back in and re-run the script!

You can then go to the next section on testing

Detailed Install

If, for some reason, you can't just run the script and you want to go through the install by hand - here's all the steps!

Update /etc/modprobe.d (if it exists)

Log into your Pi and get into a serial console (either via a console cable, the TV console, RXVT, or what have you)

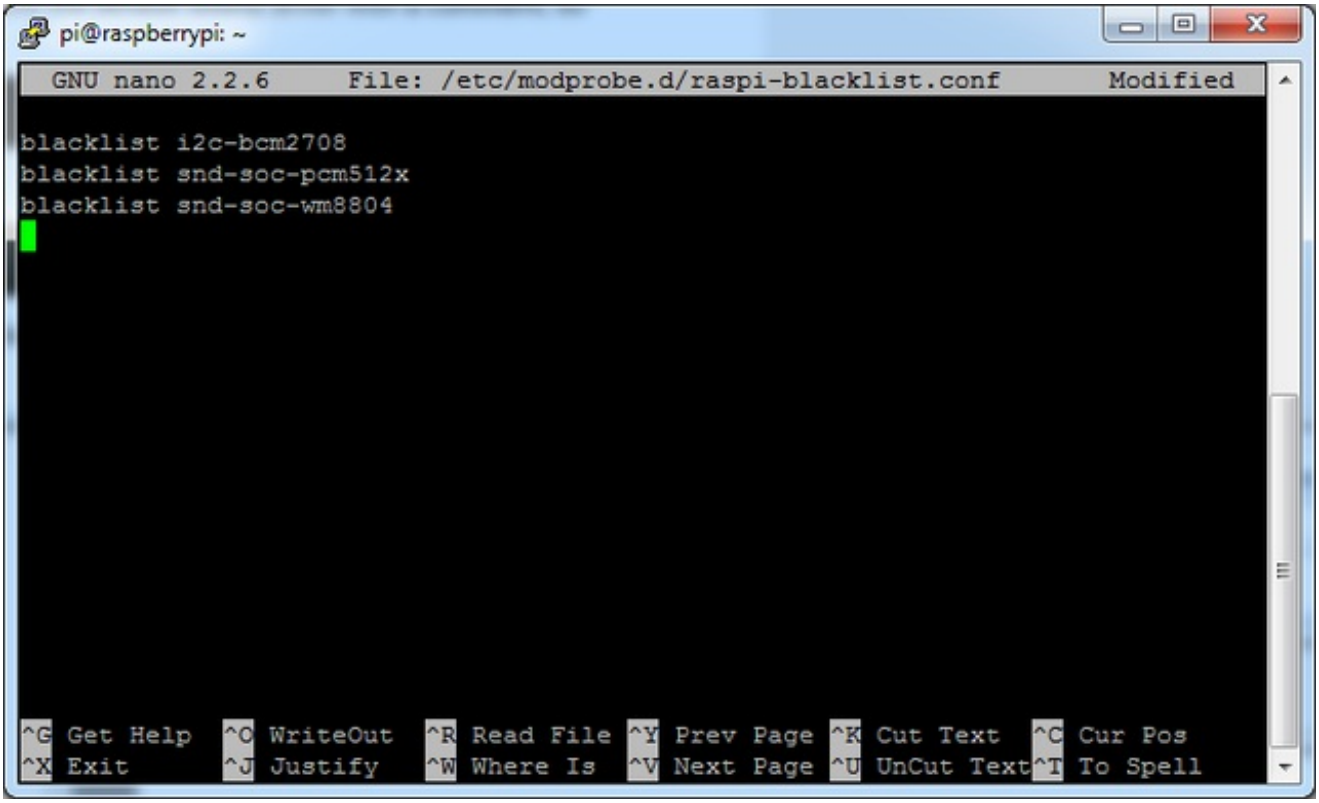
Edit the raspi blacklist with

sudo nano /etc/modprobe.d/raspi-blacklist.conf

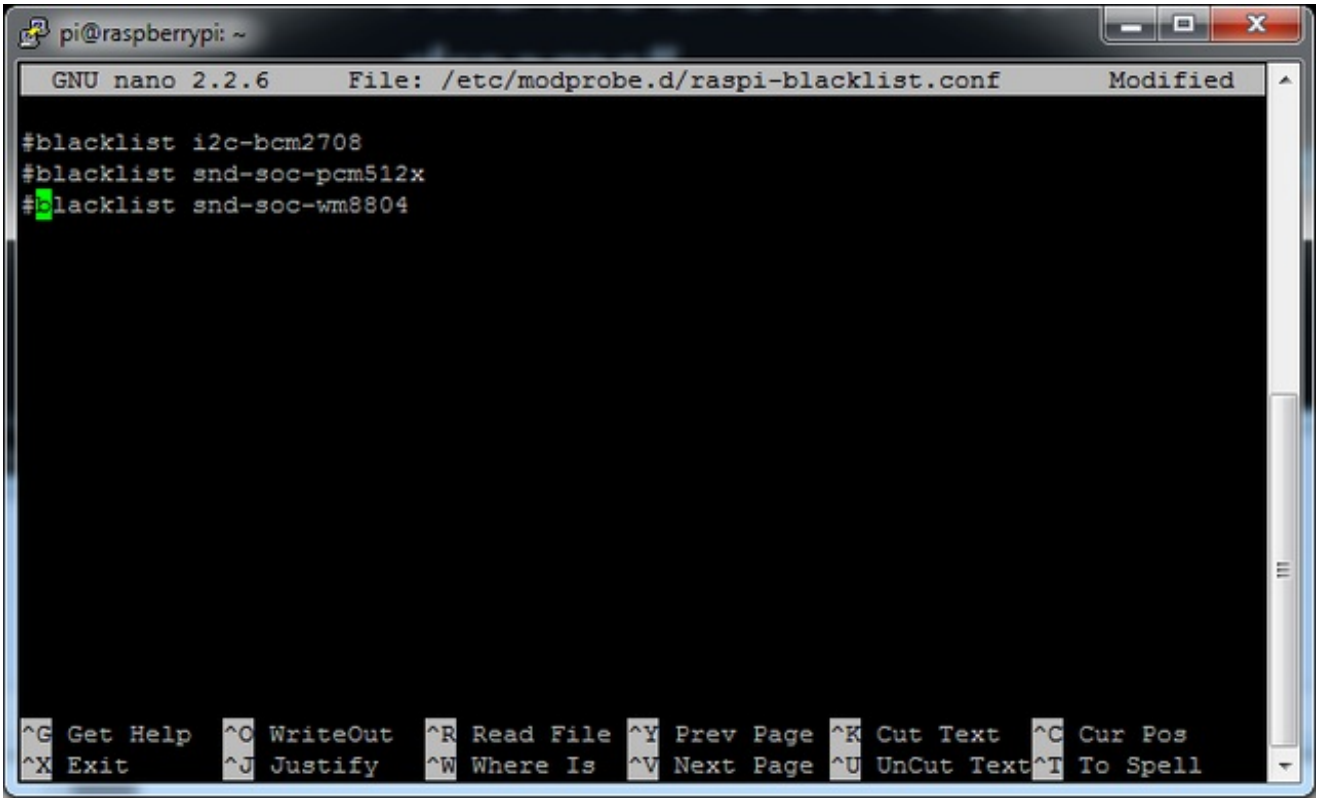
If the file is empty, just skip this step

However, if you see the following lines:

blacklist i2c-bcm2708
blacklist snd-soc-pcm512x
blacklist snd-soc-wm8804



Update the lines by putting a **#** before each line



Save by typing **Control-X Y <return>**

Disable headphone audio (if it's set)

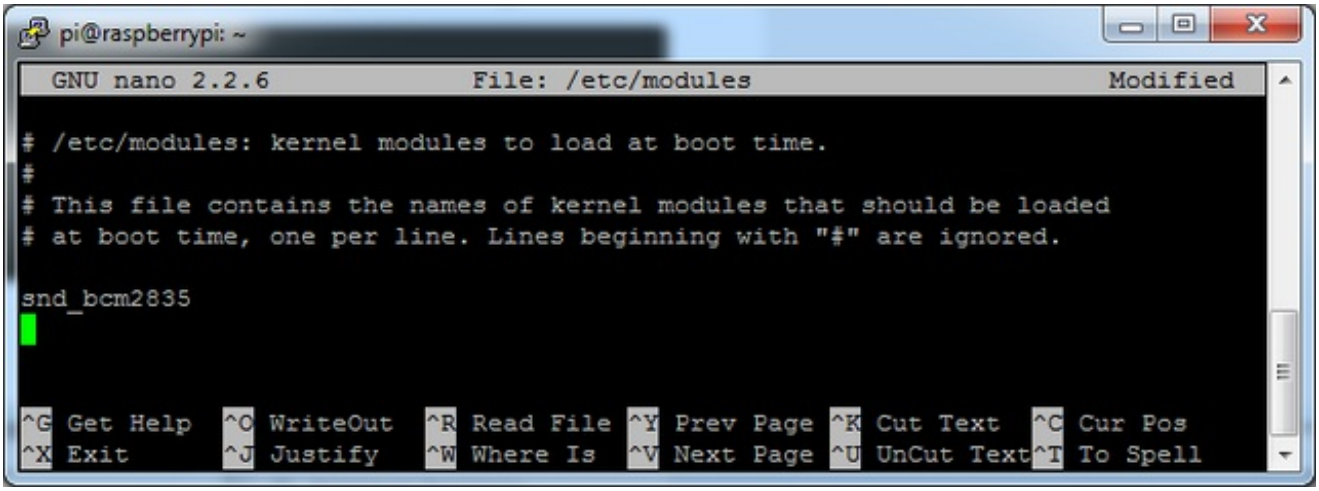
Edit the raspi modules list with

sudo nano /etc/modules

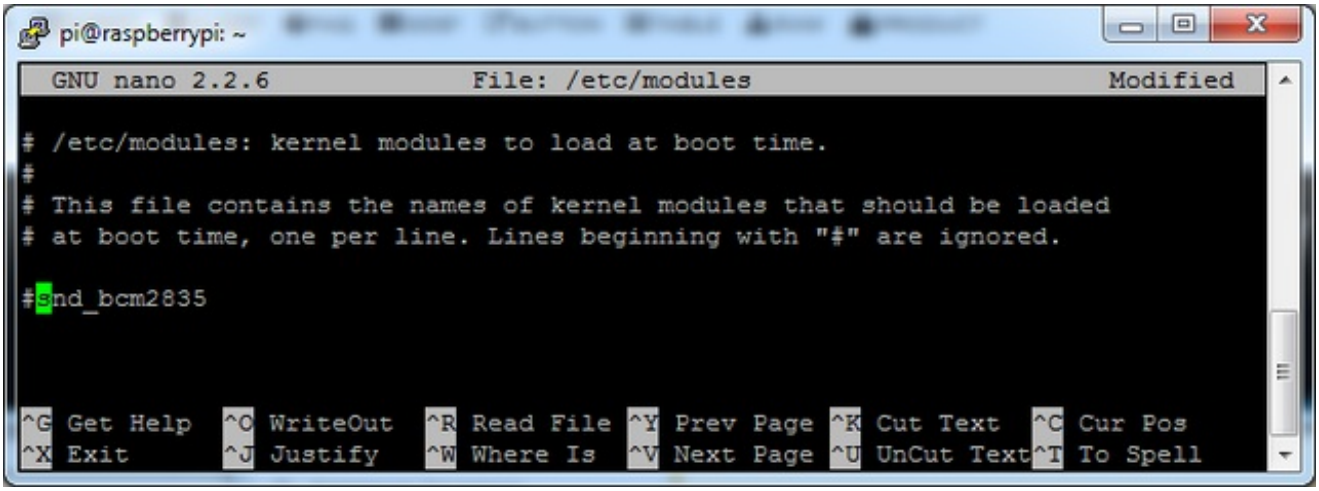
If the file is empty, just skip this step

However, if you see the following line:

snd_bcm2835



Put a **#** in front of it



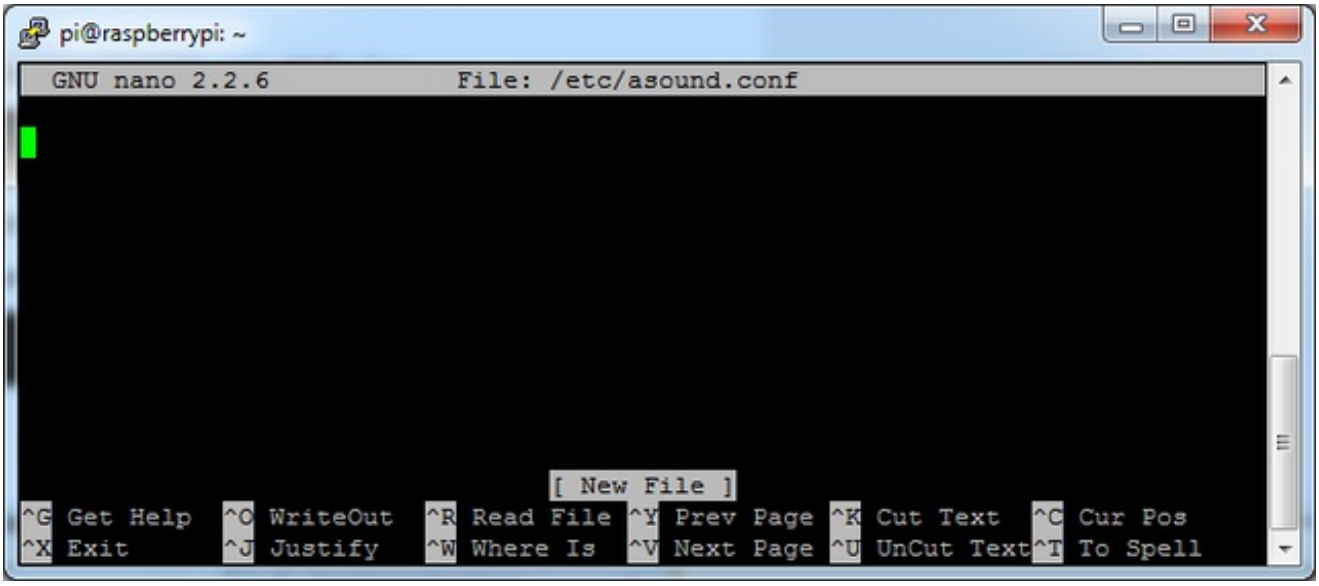
and save with **Control-X Y <return>**

Create asound.conf file

Edit the raspi modules list with

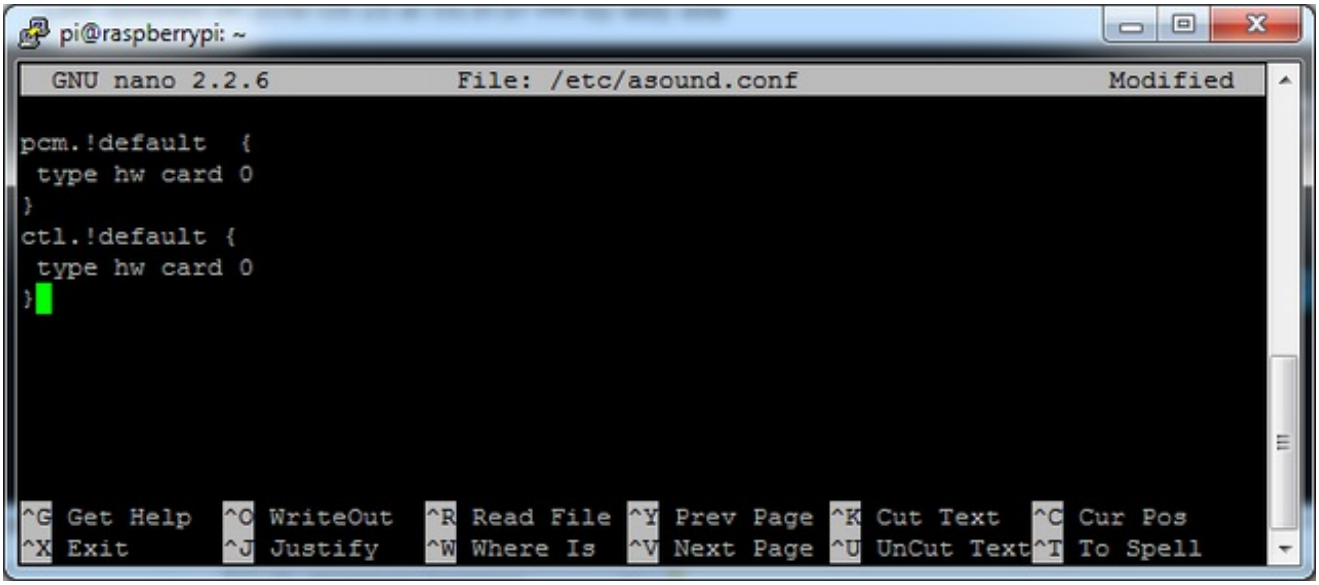
sudo nano /etc/asound.conf

This file ought to be blank!



Copy and paste the following text into the file

```
pcm.!default  {
 type hw card 0
}
ctl.!default {
 type hw card 0
}
```



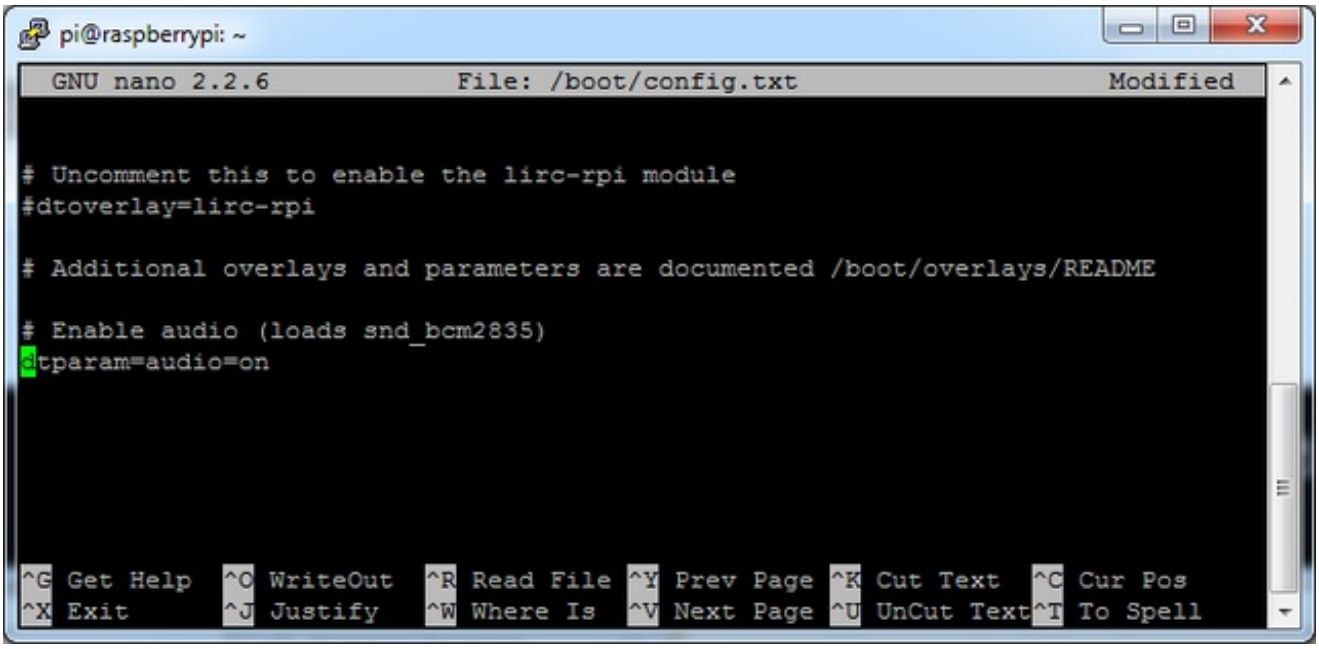
Save the file as usual

Add Device Tree Overlay

Edit your Pi configuration file with

sudo nano /boot/config.txt

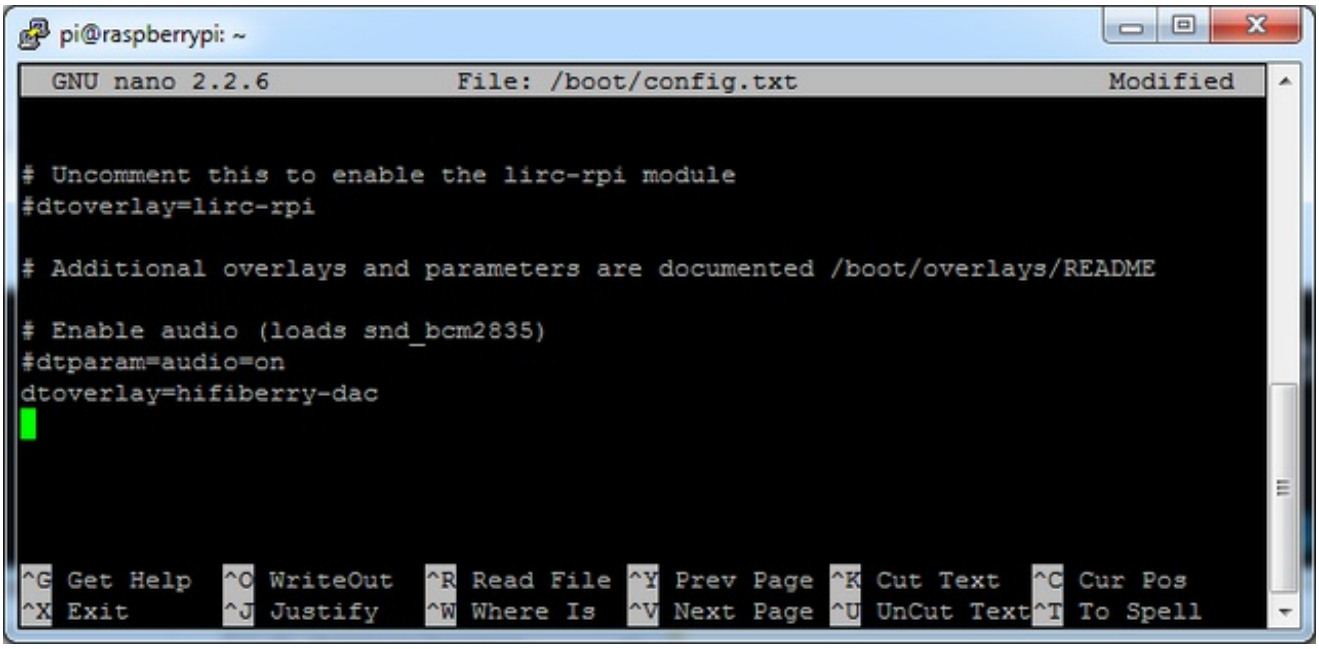
And scroll down to the bottom. If you see a line that says dtparam=audio=on



Disable it by putting a **#** in front.

Then add:
dtoverlay=hifiberry-dac

on the next line. Save the file.



Reboot your Pi with **sudo reboot**

Raspberry Pi Test

Speaker Tests!

OK you can use whatever software you like to play audio but if you'd like to test the speaker output, here's some quick commands that will let you verify your amp and speaker are working as they should!

Simple white noise speaker test

Run speaker-test -c2 to generate white noise out of the speaker, alternating left and right. Since the I2S amp merges left and right channels, you'll hear continuous white noise

Simple WAV speaker test

Once you've got something coming out, try to play an audio file with**speaker-test** (for WAV files, not MP3)

```
speaker-test -c2 --test=wav -w /usr/share/sounds/alsa/Front_Center.wav
```

Simple MP3 speaker test

If you want to play a stream of music, you can try

```
sudo apt-get install -y mpg123
mpg123 http://ice1.somafm.com/u80s-128-mp3
```

If you want to play MP3's on command, check out this tutorial which covers how to set that up (http://adafru.it/aTD)

At this time, Jessie Raspbery Pi kernel**does not support mono audio** out of the I2S interface, **you can only play stereo**, so any mono audio files may need conversion to stereo!

Reducing popping

When the I2S amplifier gets a new frequency input it may 'pop' the speakers which can be

annoying.

The workaround is to use a software mixer to output a fixed sample rate to the MAX98357 so the bit clock does not change. I use ALSA so I configured **dmixer** and I no longer have any pops or clicks. Note that the RaspPi I2S driver does not support **dmixer** by default and you must follow the instructions provided below (http://adafru.it/sHF) to modify **/boot/config.txt** to add

```
dtoverlay=i2s-mmap
```

and change **/etc/asound.conf** to:

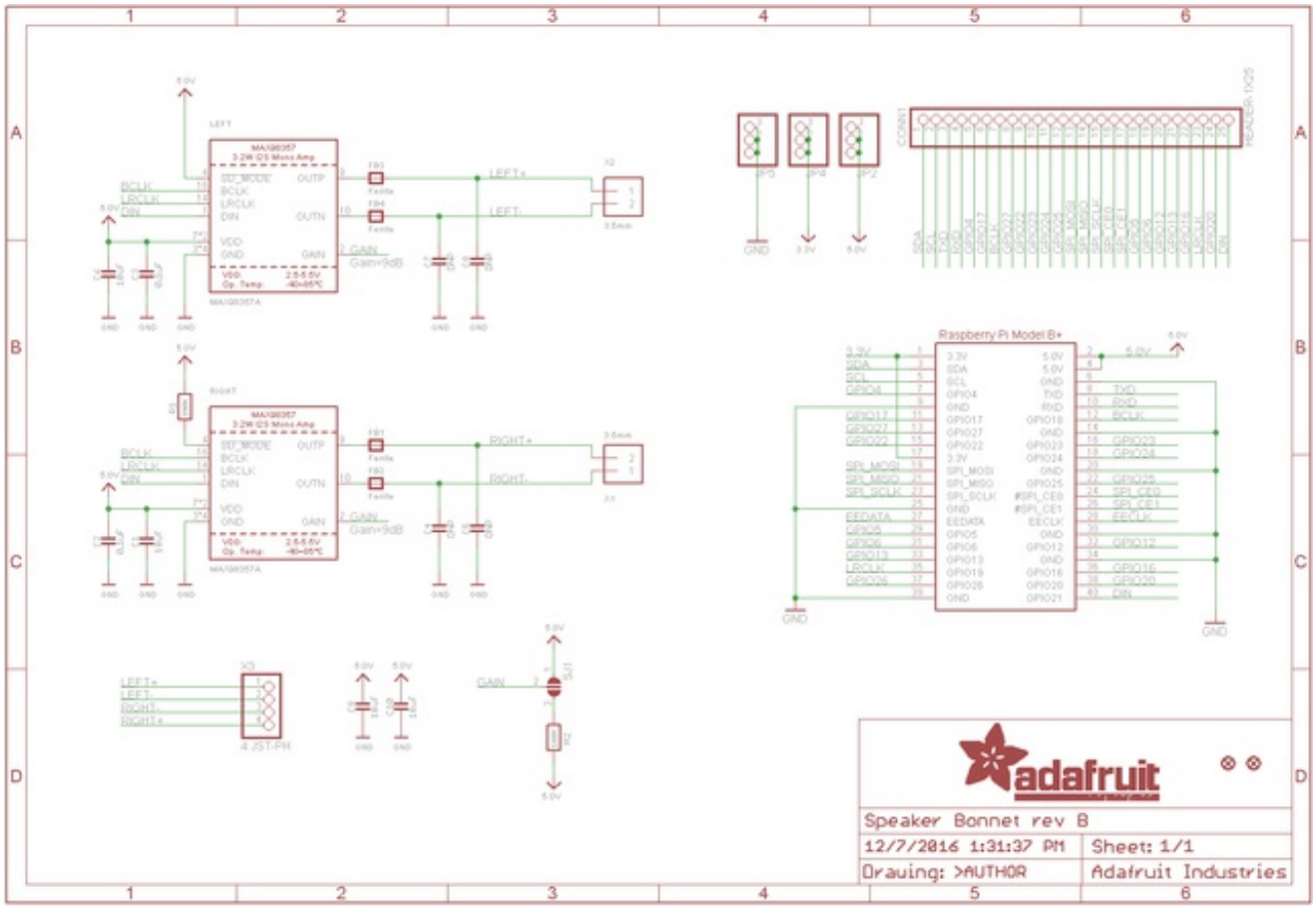
```
pcm.hifiberry {
type hw card 0
}

pcm.!default {
type plug
slave.pcm "dmixer"
}

pcm.dmixer {
type dmix
ipc_key 1024
slave {
pcm "hifiberry"
channels 2
}
}

ctl.dmixer {
type hw
card 0
}
```

Downloads

Datasheets & Files

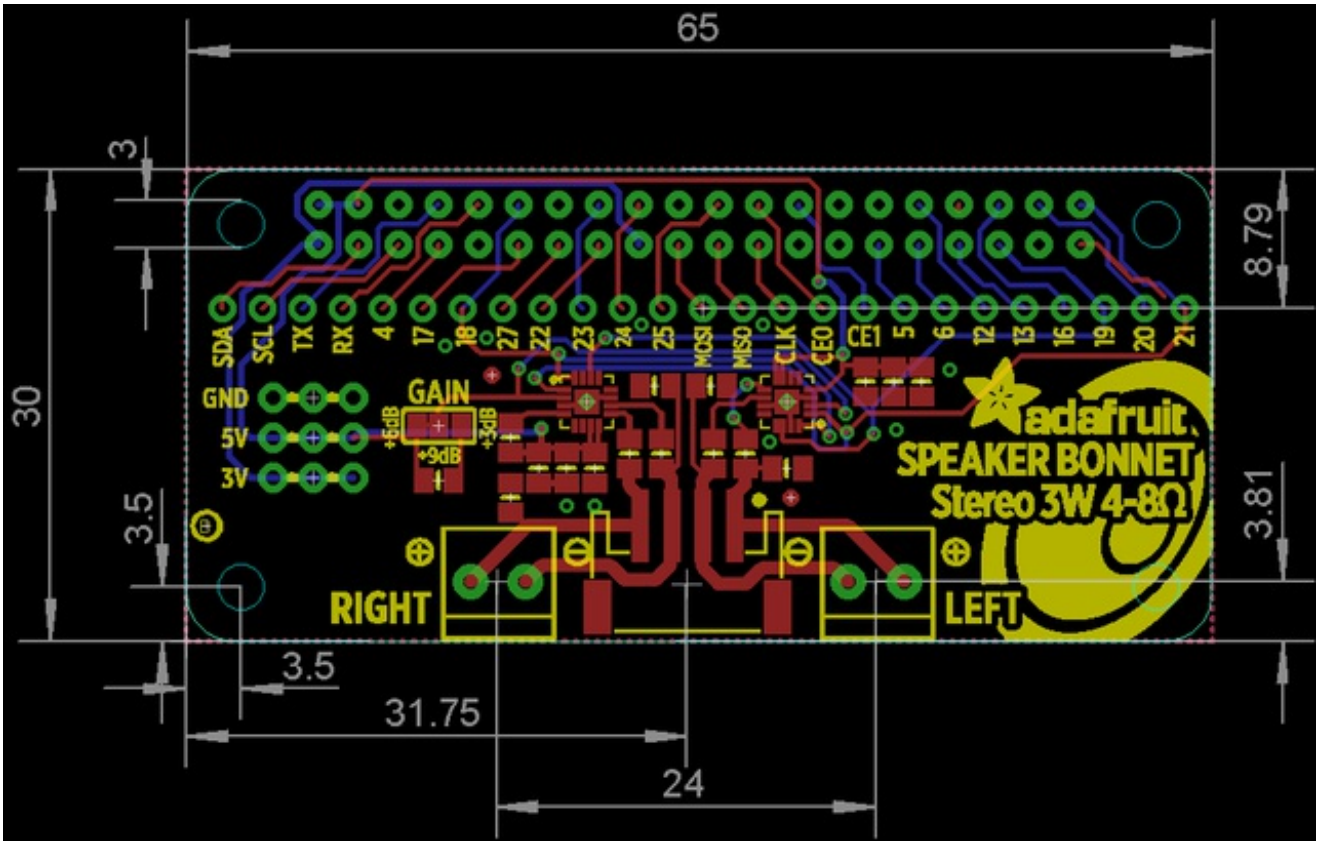
- MAX98357 Datasheet (http://adafru.it/nFz)
- EagleCAD PCB files (http://adafru.it/t1d)
- Fritzing object in Adafruit Fritzing library (http://adafru.it/c7M)

Schematic



Fabriation Print

Dims in mm


65
3
30
8.79
3.81
3.5
3.5
31.75
24
SDA
SCL
TX
RX
4
17
18
27
22
23
24
25
MOSI
MISO
CLK
CE0
CE1
5
6
12
13
16
19
20
21
GND
5V
3V
GAIN
+6dB
+3dB
+9dB
RIGHT
LEFT
adafruit
SPEAKER BONNET
Stereo 3W 4-8Ω