

Interfacing Raspberry Pi with S2GO MEMSMIC IM69D (Silicon Microphone)

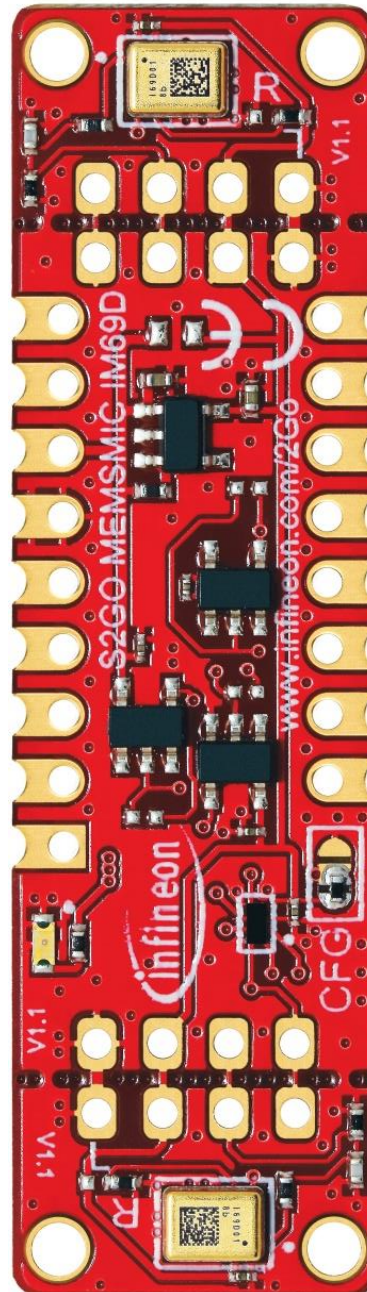


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1 Installation steps

1.1 Pre-requisites

It is assumed that you are reading this document after downloading and installation of Raspbian in a microSD card and Raspberry Pi is booted up with an internet connection as many packages will be required, to install these packages active internet connection is required.

If this is not the case, and you have opened this document from somewhere else, then please follow the steps given below then proceed further.

Steps

- 1- Install Balena Etcher software.
[Link](#)
- 2- One Micro SD card and card reader.
Recommended atleast 16GB card and Class10 supporting least speed of 48Mb/s.
- 3- Download Raspbian operating system for Raspberry Pi.
[Link](#)
- 4- One Display is required to operate the raspberry pi with HDMI input.
In case display does not support HDMI input then appropriate convertor is required.
- 5- Active internet connection is required in Raspberry Pi.

Once you are done with these steps you are good to go further in document and do installation of the packages required to run [IM69D130-Microphone-S2Go](#).

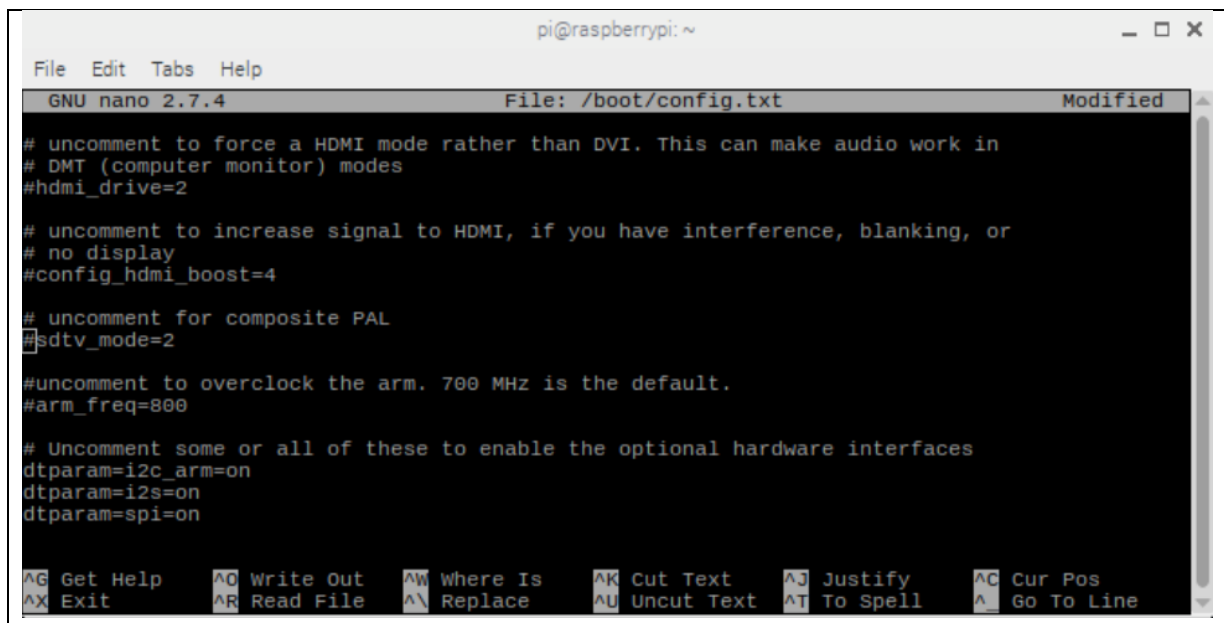
1.2 Enable I2S input in Raspberry Pi

Note: - Log into your Raspberry pi via a terminal, recommended ssh ([Putty](#)) or [VNC Server/Viewer](#) to copy and paste the commands.

- Enable i2s support by editing **/boot/config.txt**
sudo nano /boot/config.txt

Uncomment **#dtparam=i2s=on** (Figure 1)

(Remove the # from the start of line) save and exit from the file.



```

pi@raspberrypi: ~
File Edit Tabs Help
GNU nano 2.7.4 File: /boot/config.txt Modified
# uncomment to force a HDMI mode rather than DVI. This can make audio work in
# DMT (computer monitor) modes
#hdmi_drive=2

# uncomment to increase signal to HDMI, if you have interference, blanking, or
# no display
#config_hdmi_boost=4

# uncomment for composite PAL
#sdtv_mode=2

#uncomment to overclock the arm. 700 MHz is the default.
#arm_freq=800

# Uncomment some or all of these to enable the optional hardware interfaces
dtparam=i2c_arm=on
dtparam=i2s=on
dtparam=spi=on

^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell ^_ Go To Line
  
```

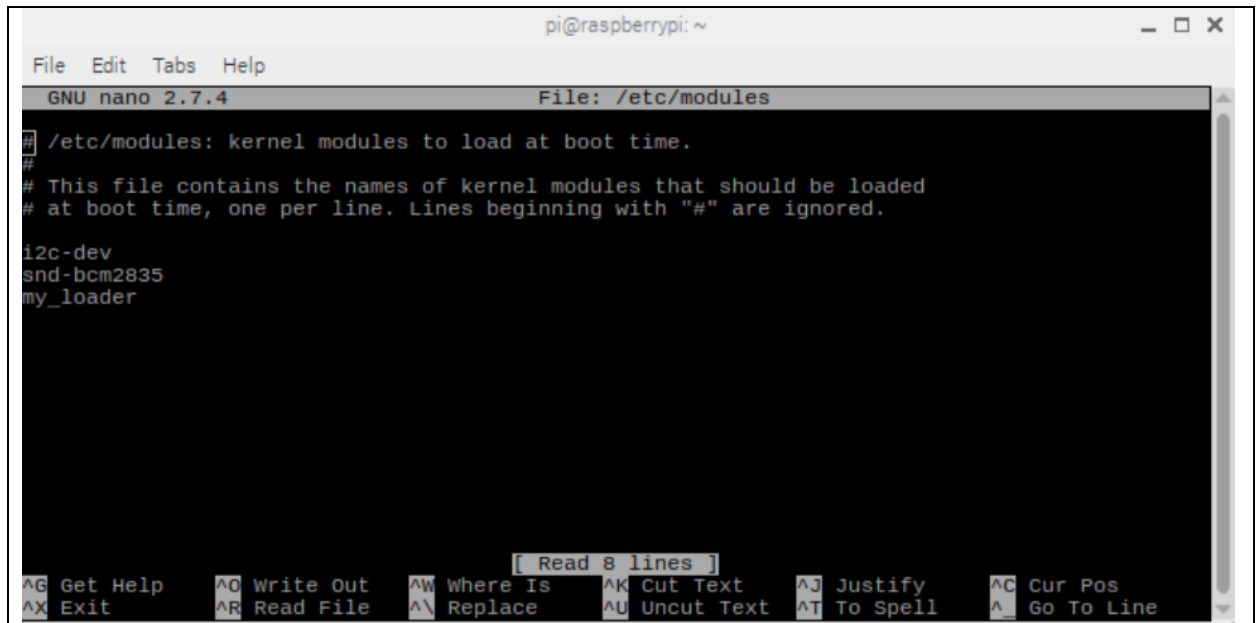
Figure 1 Confirms that I2S is enabled

- Make sure sound support is enabled in the kernel
sudo nano /etc/modules

Add a line at the end

snd-bcm2835

Save and exit from the file.



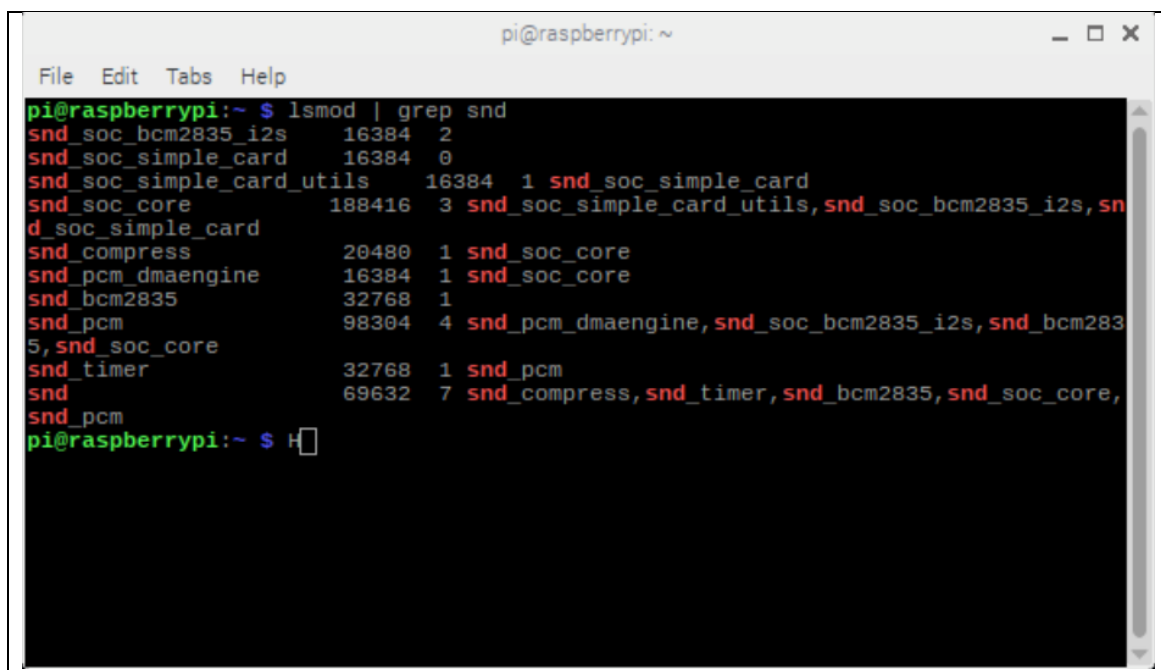
```

pi@raspberrypi: ~
File Edit Tabs Help
GNU nano 2.7.4 File: /etc/modules
# /etc/modules: kernel modules to load at boot time.
#
# This file contains the names of kernel modules that should be loaded
# at boot time, one per line. Lines beginning with "#" are ignored.
i2c-dev
snd-bcm2835
my_loader
[ Read 8 lines ]
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell ^_ Go To Line

```

Figure 2 Add snd-bcm2835

- Now reboot your pi
sudo reboot
- Enter the following to confirm the modules are loaded.
lsmod | grep snd



```

pi@raspberrypi: ~
File Edit Tabs Help
pi@raspberrypi:~$ lsmod | grep snd
snd_soc_bcm2835_i2s      16384 2
snd_soc_simple_card     16384 0
snd_soc_simple_card_utils 16384 1 snd_soc_simple_card
snd_soc_core            188416 3 snd_soc_simple_card_utils,snd_soc_bcm2835_i2s,snd_soc_simple_card
snd_compress            20480 1 snd_soc_core
snd_pcm_dmaengine       16384 1 snd_soc_core
snd_bcm2835              32768 1
snd_pcm                 98304 4 snd_pcm_dmaengine,snd_soc_bcm2835_i2s,snd_bcm2835,snd_soc_core
snd_timer               32768 1 snd_pcm
snd                      69632 7 snd_compress,snd_timer,snd_bcm2835,snd_soc_core,snd_pcm
pi@raspberrypi:~$

```

Figure 3 Generated output after the command

1.3 Download I2S Module

- Start by updating your Pi:

```
sudo apt-get update
```

```
sudo apt-get install rpi-update
```

```
sudo rpi-update
```

Reboot to run Pi with updates.

- Install the compilation dependencies:
- ```
sudo apt-get install git bc libncurses5-dev bison flex libssl-dev
```

- Download kernel source & compile:  
(Run all the 4 commands in same sequence)

```
sudo wget https://raw.githubusercontent.com/notro/rpi-source/master/rpi-source -O /usr/bin/rpi-source
```

```
sudo chmod +x /usr/bin/rpi-source
```

```
/usr/bin/rpi-source -q --tag-update
```

```
rpi-source --skip-gcc
```

**Note:** - On a Pi 3 this will take time, so don't worry if it's taking 15 minutes.

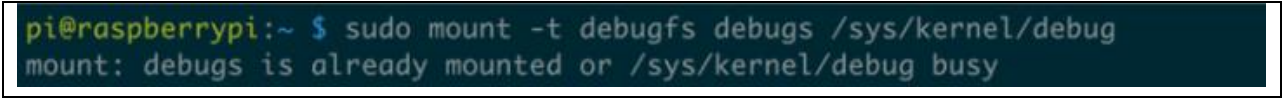
If the script pauses at this prompt-

```
Code coverage for fuzzing (KCOV) [N/y/?] (NEW)
```

Just press enter to accept the default and continue

## 1.4 Compile I2S Module

- Compile the i2s Module:  
`sudo mount -t debugfs debugs /sys/kernel/debug`



```
pi@raspberrypi:~ $ sudo mount -t debugfs debugs /sys/kernel/debug
mount: debugs is already mounted or /sys/kernel/debug busy
```

Figure 4 Generated output after the command

If you are getting this you are on right path carry on.

- `sudo cat /sys/kernel/debug/asoc/platforms`

If you are using Pi 3 or Pi 2 - make sure the module name is **3f203000.i2s**

You may get the output as “No such file or directory” no problem you can still carry on its because of latest kernel **platforms** file is replaced with **components**.

- Download the module, written by [Paul Creaser](https://github.com/PaulCreaser/rpi-i2s-audio)

```
git clone https://github.com/PaulCreaser/rpi-i2s-audio
```

```
cd rpi-i2s-audio
```

- Static loading the module:

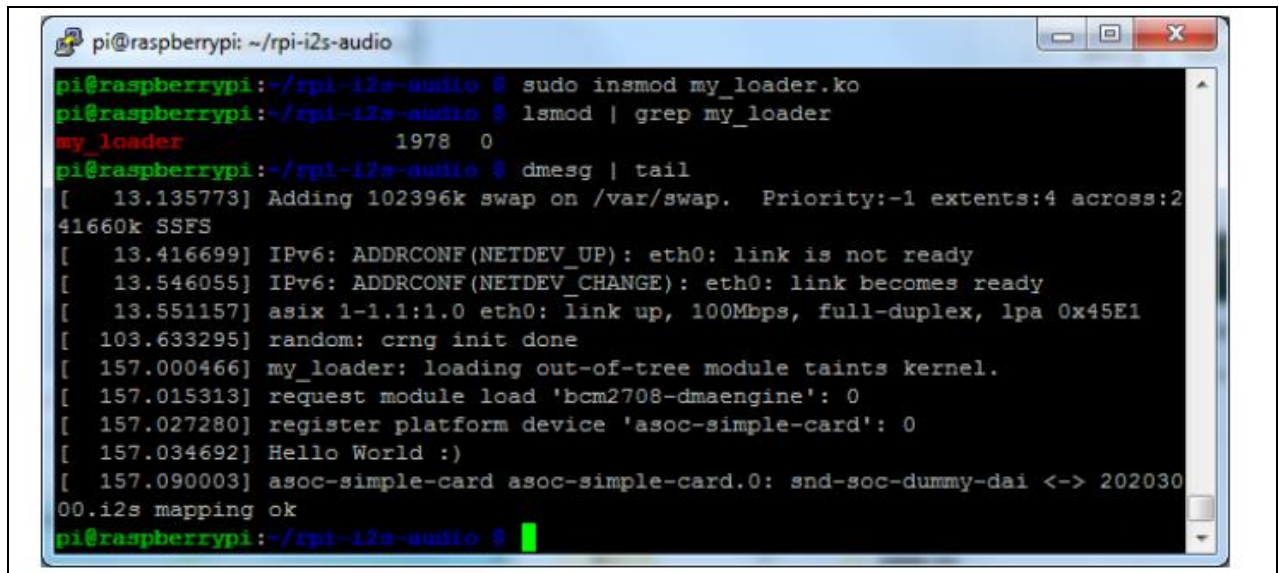
```
make -C /lib/modules/$(uname -r)/build M=$(pwd) modules
```

```
sudo insmod my_loader.ko
```

- Verify the module is loaded:

```
lsmod | grep my_loader
```

```
dmesg | tail
```



```

pi@raspberrypi: ~/rpi-i2s-audio
pi@raspberrypi:~/rpi-i2s-audio $ sudo insmod my_loader.ko
pi@raspberrypi:~/rpi-i2s-audio $ lsmod | grep my_loader
my_loader 1978 0
pi@raspberrypi:~/rpi-i2s-audio $ dmesg | tail
[13.135773] Adding 102396k swap on /var/swap. Priority:-1 extents:4 across:2
41660k SSFS
[13.416699] IPv6: ADDRCONF(NETDEV_UP): eth0: link is not ready
[13.546055] IPv6: ADDRCONF(NETDEV_CHANGE): eth0: link becomes ready
[13.551157] asix 1-1.1:1.0 eth0: link up, 100Mbps, full-duplex, lpa 0x45E1
[103.633295] random: crng init done
[157.000466] my_loader: loading out-of-tree module taints kernel.
[157.015313] request module load 'bcm2708-dmaengine': 0
[157.027280] register platform device 'asoc-simple-card': 0
[157.034692] Hello World :)
[157.090003] asoc-simple-card asoc-simple-card.0: snd-soc-dummy-dai <-> 202030
00.i2s mapping ok
pi@raspberrypi:~/rpi-i2s-audio $

```

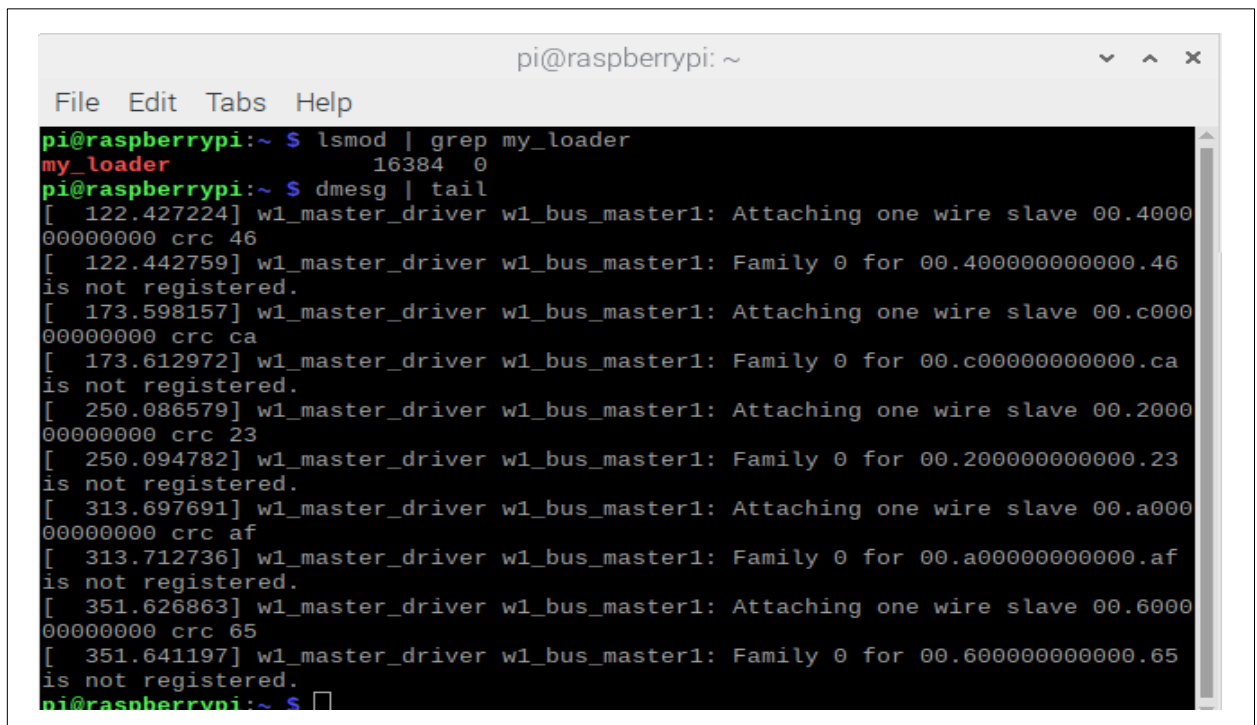
Figure 5 To check in loader I2S mapping

Note that on the Pi 2/3 you'll see-

**asoc-simple-card asoc-simple-card.0: snd-soc-dummy-dai <-> 3F203000.i2s mapping ok**

**Note:** -You may also get some other lines also that's completely fine, you must get **mapping ok** line (Figure 5).

**Note:** -Depending on the kernel version output may vary (Figure 6).



```

pi@raspberrypi: ~
File Edit Tabs Help
pi@raspberrypi:~ $ lsmod | grep my_loader
my_loader 16384 0
pi@raspberrypi:~ $ dmesg | tail
[122.427224] w1_master_driver w1_bus_master1: Attaching one wire slave 00.4000
00000000 crc 46
[122.442759] w1_master_driver w1_bus_master1: Family 0 for 00.400000000000.46
is not registered.
[173.598157] w1_master_driver w1_bus_master1: Attaching one wire slave 00.c000
00000000 crc ca
[173.612972] w1_master_driver w1_bus_master1: Family 0 for 00.c00000000000.ca
is not registered.
[250.086579] w1_master_driver w1_bus_master1: Attaching one wire slave 00.2000
00000000 crc 23
[250.094782] w1_master_driver w1_bus_master1: Family 0 for 00.200000000000.23
is not registered.
[313.697691] w1_master_driver w1_bus_master1: Attaching one wire slave 00.a000
00000000 crc af
[313.712736] w1_master_driver w1_bus_master1: Family 0 for 00.a00000000000.af
is not registered.
[351.626863] w1_master_driver w1_bus_master1: Attaching one wire slave 00.6000
00000000 crc 65
[351.641197] w1_master_driver w1_bus_master1: Family 0 for 00.600000000000.65
is not registered.
pi@raspberrypi:~ $

```

Figure 6 To check in loader I2S mapping



### Auto load the module on startup

- `sudo cp my_loader.ko /lib/modules/$(uname -r)`
- `echo 'my_loader' | sudo tee --append /etc/modules > /dev/null`
- `sudo depmod -a`
- `sudo modprobe my_loader`

### Reboot your Pi

#### You are all set to record sound from Mems microphone

- command to list the available input devices:  
`arecord -l`

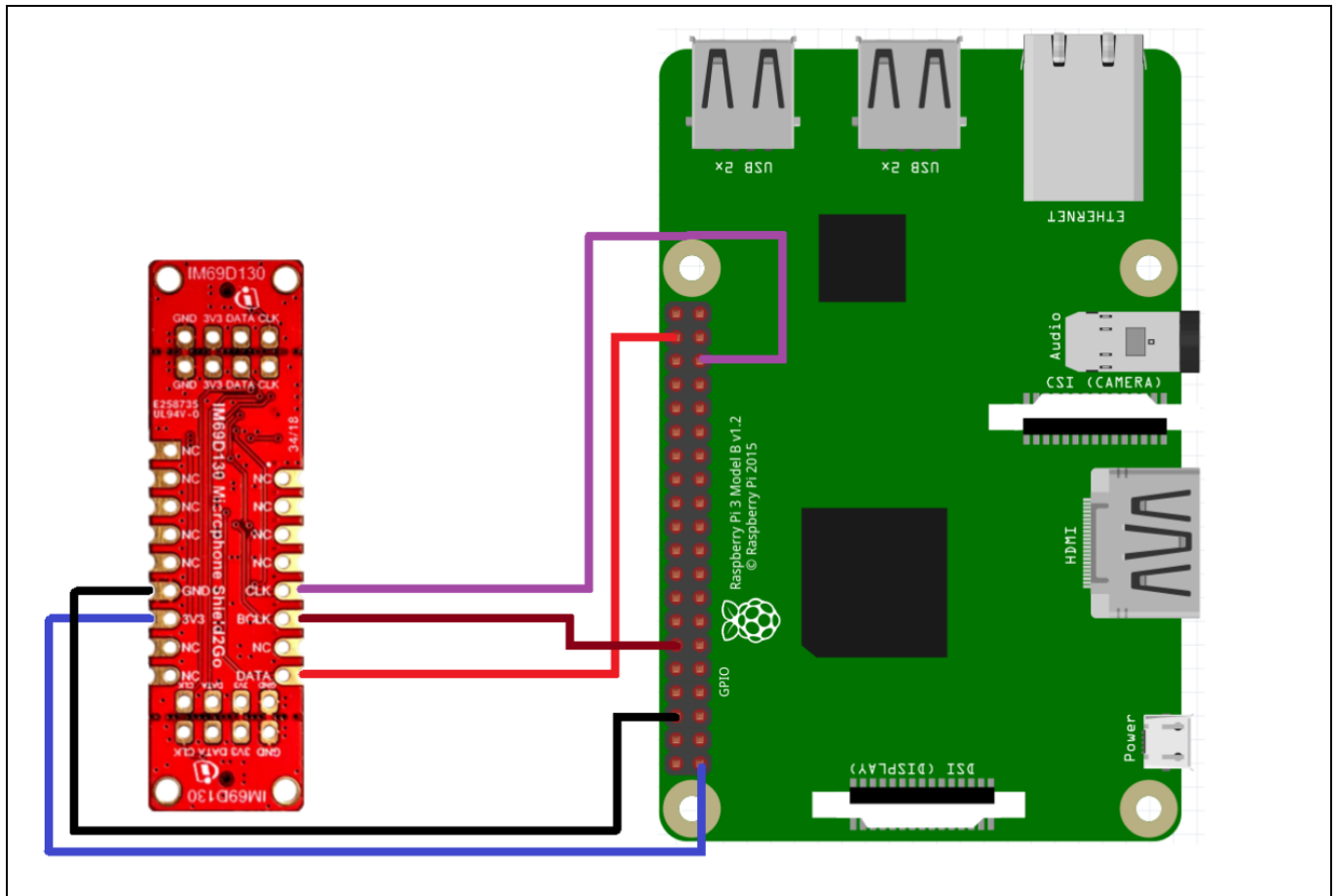


```
pi@raspberrypi: ~
File Edit Tabs Help
pi@raspberrypi:~ $ arecord -l
**** List of CAPTURE Hardware Devices ****
card 1: sndrpi_simplecar [snd_rpi_simple_card], device 0: simple-card_codec_link
snd-soc-dummy-dai-0 []
 Subdevices: 1/1
 Subdevice #0: subdevice #0
pi@raspberrypi:~ $
```

Figure 6 To check List of Capture Hardware devices

**Note:** -You should see a `snd_rpi_simple_card`

## 2 Connection Diagram



**Figure 7 Mems Microphone connection with Raspberry Pi**

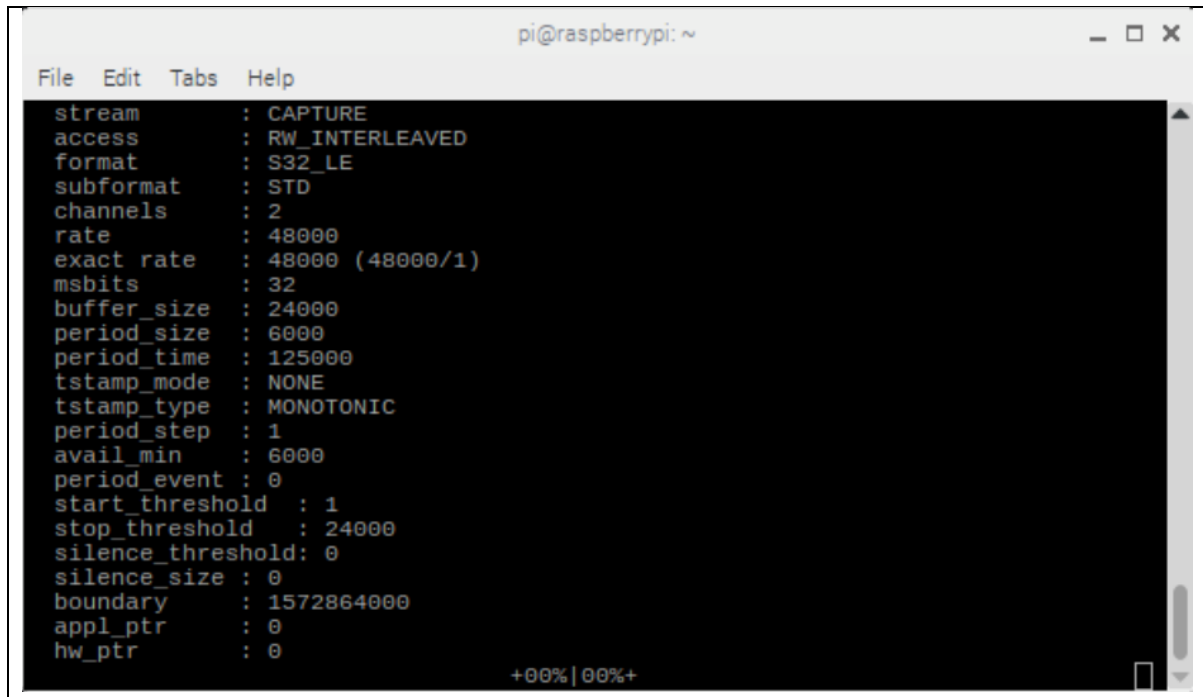
### Pin to pin connection

GND – Pi Ground (pin 6)  
 3V3 – Pi 3.3V (pin1)  
 DATA – BCM 20 (pin 38)  
 BCLK – BCM 18 (pin 12)  
 CLK – BCM 19 (pin 35)

### 3 Recording and Playback

- You can record a wav file with this command  
**arecord -D plughw:1 -c1 -r 48000 -f S32\_LE -t wav -V mono -v file.wav**

If all is working correctly, you should see the VU meter react at the bottom of the terminal window.



**Figure 8 VU meter recording voice**

**Note:** -To stop the recording give keyboard interrupt Ctrl + C.

- Test the recorded file  
**aplay file.wav**

**Note:** - If you want to re-record and on giving same command if it shows resource busy then give this command.  
**sudo killall -9 arecord**

#### Getting output from 3.5mm jack in Raspberry Pi

There are 3 ways from which you can get audio output from Pi, defined by numbers-

- 0- This is the default setting which is automatic.
- 1- This is for getting the output from headphone jack 3.5mm.
- 2- This output is set to HDMI.

Command to change the audio output-

**amixer cset numid=3 1**

This will change the output from default to 3.5mm.

**Note:** - IM69D130-Microphone-S2Go comes with two microphones can work in stereo form as well.

**arecord -D plughw:1 -c2 -r 48000 -f S32\_LE -t wav -V stereo -v file.wav**

**Note:** - Process of recording and playing back can be done using one simple command with a time limit that it will record for 10 seconds will replay the recorded file.

**arecord -duration 10 -D plughw:1 -c2 -r 48000 -f S32\_LE -t wav -V stereo -v file.wav && aplay ./file.wav**

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**Edition 2017-04**

**Published by**  
**Infineon Technologies AG**  
**81726 Munich, Germany**

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