This schematic is used with my Raspberry Pi (RasPi) project, Sound Box.

* Connect 5V_IN (J1) with 5 volts power pin of RasPi.
* Connect PWM_IN (J2) with GPIO 12 or 13 of RasPi.
* Connect GND (J3) with any ground pin of RasPi.
* U1A is a buffer, made of a voltage follower. RasPi can drive with the least current for stability and preventing brown out.
* R1, C1, and U1B make a low-pass filter. The cut-off frequency is appx. 16000 Hz.
    Option: A 100KB variable resister next to R1 in series (cut-off 160 Hz − 16000 Hz)
* R2, Q1, and D1 make a speaker driver. If you would like to change the drive-power, change the resistance of R2.
    Option: A 100KA variable resister next to R2 in series
* Q1 is a low frequency amplifier or an audio driver. Several amplifiers/drivers exist, e.g., 2SC2120.

In this schematic, the speaker driver don't cut direct current.
Inputting high-power direct current breaks the speaker.
If you would like to cut direct current,
you need to apply a transformer.
Note that this schematic assumes coils as non-ideal.
That is; coils have resistance for direct current,
and the short circuit against coil surge, D1 and LS1, has resistance.

Check if your speaker smokes on driving.
If so, immediately stop using your speaker for safety.
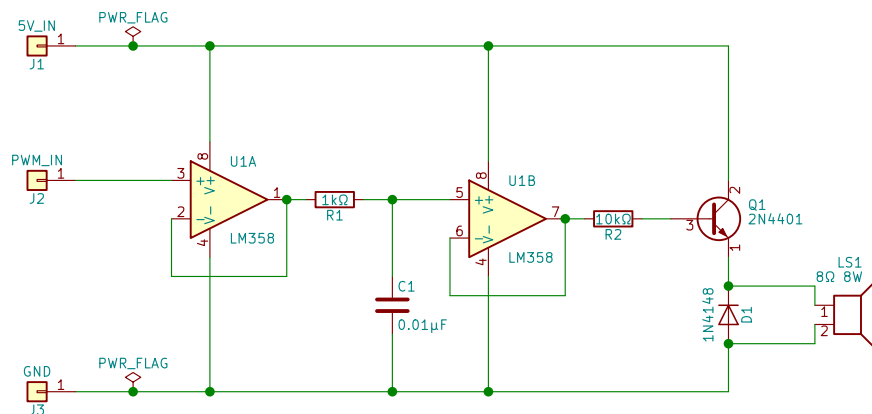
⊙Sound Box: Maximum peak-to-peak voltage of PWM output is 1.3464 volts, and the bias voltage is 1.64736 volts.
Caution that RasPi's input/output voltage is 3.3 volts. Don't input 5 volts to RasPi's input/output.

This schematic is exempt from warranty, responsibility, and liability from any kind and any damage.

5V_IN
PWR_FLAG
J1
1

PWM_IN
J2
1

U1A
3
2
1
8
4
V+
V−
LM358

1kΩ
R1

C1
0.01µF

U1B
5
6
7
8
4
V+
V−
LM358

10kΩ
R2

Q1
2N4401
2
3
1

1N4148
D1

LS1
8Ω 8W
1
2

GND
PWR_FLAG
J3
1

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Sheet: /
File: sound_system_pwm.sch
Title: Sound System for PWM Output
Size: A4   Date: 2018−12−08   Rev: 1.0.1
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