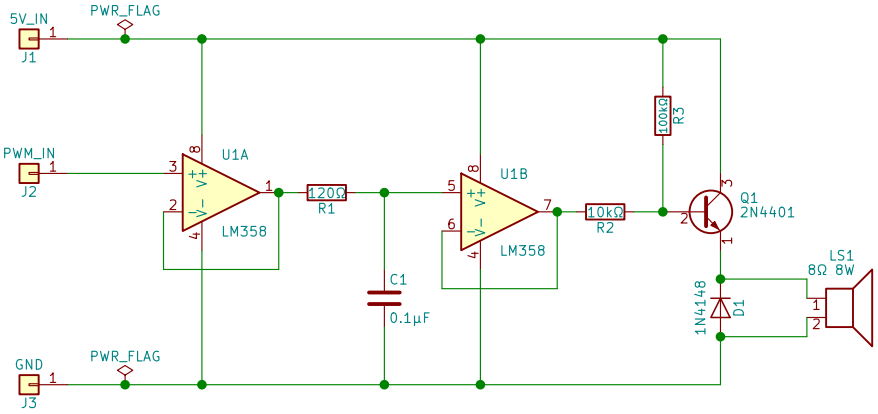
* Connect 5V_IN (J1) with 5 volts power pin of Raspberry Pi (RasPi).
* Connect PWM_IN (J2) with GPIO 12 or 13 of RasPi.
* Connect GND (J3) with any ground pin of RasPi.
* U1A is a buffer made of a voltage follower, so that RasPi can drive with the least current for stability and preventing brownout.
* R1, C1, and U1B make a low-pass filter. The cut-off frequency is approx. 13270 Hz.
  Option: B10K potentiometer next to R1 in series (cut-off 157 Hz – 13270 Hz). Caution that high resistance makes voltage drop.
* R2, Q1, and D1 make a speaker driver. If you would like to change the drive-power, change the resistance of R2.
  Option: A100K potentiometer 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.
Applying 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 apply 5 volts to RasPi's input/output.

Single-supply Op-amps (U1A and U1B):
* Output voltage close to 0 volt doesn't have linearity following with input voltage.
* Output voltage close to power supply voltage doesn't have linearity following with input voltage.
  So, we need to make voltage of the lowest voltage bottom up,
  and have limitation of the highest voltage.
* There is input bias current in each Op-amp.
  So, R1 needs low resistance, otherwise voltage drop occurs.

V.2.0.0: + R3 for Bias Voltage. R1 and C1 to Consider Input Bias Current

JimmyKenMerchant

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File: sound_system_pwm.sch

Title: Sound System for PWM Output

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