ECE 341: Junior Design

Accelerated Project Amplifier Design

Written by Mark Ellarma

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1 Schematic

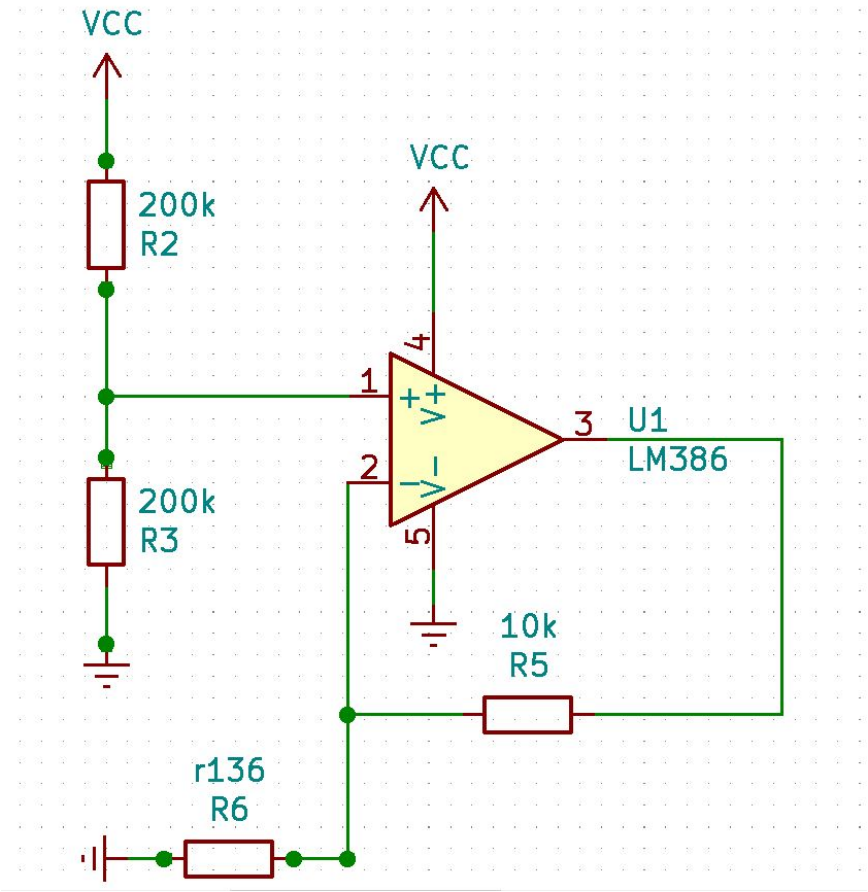

Figure 1: Amplifier Schematic

2 Datasheet

Parameter	Conditions	Min	Typ	Max	Units
Operating Supply Voltage (V_S)					
LM386N-1, -3, LM386M-1, LM386MM-1		4		12	V
LM386N-4		5		18	V
Quiescent Current (I_Q)	V_S = 6V, V_{IN} = 0		4	8	mA
Output Power (P_{OUT})					
LM386N-1, LM386M-1, LM386MM-1	V_S = 6V, R_L = 8Ω, THD = 10%	250	325		mW
LM386N-3	V_S = 9V, R_L = 8Ω, THD = 10%	500	700		mW
LM386N-4	V_S = 16V, R_L = 32Ω, THD = 10%	700	1000		mW
Voltage Gain (A_V)	V_S = 6V, f = 1 kHz		26		dB
	10 µF from Pin 1 to 8		46		dB
Bandwidth (BW)	V_S = 6V, Pins 1 and 8 Open		300		kHz
Total Harmonic Distortion (THD)	V_S = 6V, R_L = 8Ω, P_{OUT} = 125 mW f = 1 kHz, Pins 1 and 8 Open		0.2		%
Power Supply Rejection Ratio (PSRR)	V_S = 6V, f = 1 kHz, C_{BYPASS} = 10 µF Pins 1 and 8 Open, Referred to Output		50		dB
Input Resistance (R_{IN})			50		kΩ
Input Bias Current (I_{BIAS})	V_S = 6V, Pins 2 and 3 Open		250		nA

Figure 2: Amplifier Datasheet

3 Calculations

1. Set the amplifier input common mode voltage to mid–supply voltage. The equivalent resistance of R2 in parallel with R3 should be 10 times larger than R1 so that a majority of the microphone current flows through R1.

$$R_{eq} = R_2||R_3 > 10R_1 = 100\,\text{k}\Omega$$
$$R_2 = R_3 = \boxed{200\,\text{k}\Omega}$$

2. Calculate the maximum input voltage.

$$R_{in} = R_1||R_{eq} = 5.9\,\text{k}\Omega||100\,\text{k}\Omega = 5.571\,\text{k}\Omega$$
$$V_{in} = I_{max} * R_{in} = 7.221\,\mu\text{A} * 5.571\,\text{k}\Omega = \boxed{40.229\,\mu\text{V}}$$

3. Calculate gain required to produce the largest output voltage swing.

$$Gain = \frac{V_{outmax}}{V_{in}} = \frac{3\,\text{V}}{40.229\,\mu\text{V}} = \boxed{74.573\,\frac{\text{V}}{\text{V}}}$$
$$V_{outmax} < V_{rms} \rightarrow V_{rms} = \frac{1}{\sqrt{2}} * 5\,\text{V} = 3.54\,\text{V}$$

4. Calculate R4 to set the gain calculated in previous step. Select feedback resistor R5 as 10k.

$$R_4 = \frac{R_5}{Gain - 1} = \frac{10\,\text{k}\Omega}{74.573\,\frac{\text{V}}{\text{V}} - 1} \approx \boxed{136\,\Omega}$$