



## Descriptions

The LM386MX-1/NOPB audio power amplifier is mainly used in low voltage consumer products. To minimize peripheral components, the voltage gain is built-in to 20. But add an external resistor and capacitor between 1 and 8 pins to set the voltage gain to any value up to 200. The input is ground-referenced and the output is automatically offset to half the supply voltage.

At 6V supply voltage, its static power consumption is only 24mW, making LM386MX-1/NOPB especially suitable for battery-powered occasions.

## Feature

- Battery Operation
- Minimum External Parts
- Wide Supply Voltage Range: 4 V–12 V
- Low Quiescent Current Drain: 4 mA
- Voltage Gains from 20 to 200
- Ground-Referenced Input
- Self-Centering Output Quiescent Voltage
- Low Distortion: 0.2% ( $A_v = 20$ ,  $V_s = 6$   
 $R_L = 8\ \Omega$ ,  $P_o = 125\text{ mW}$ ,  $f = 1\text{ kHz}$ )

## Applications

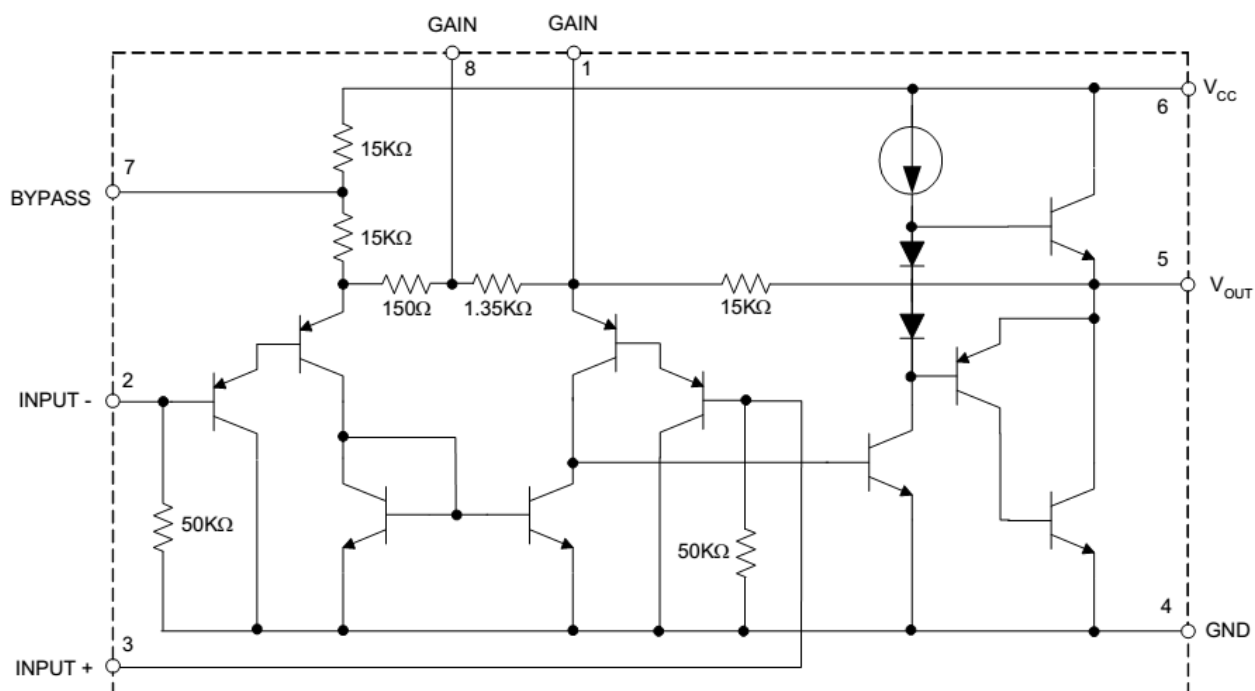
- Active Filter
- AM-FM Radio Amplifiers Portable
- Tape Player Amplifiers Intercoms
- TV Sound Systems
- Line Drivers
- Ultrasonic Drivers
- Small Servo Drivers
- Power Converters Industrial

## Ordering Information

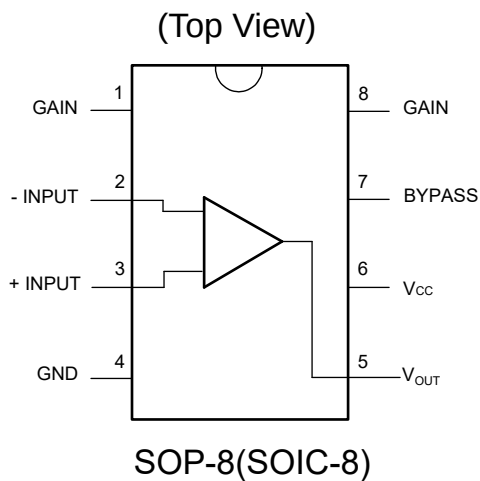
| Product Model  | Package Type  | Packing | Packing Qty  |
|----------------|---------------|---------|--------------|
| LM386MX-1/NOPB | SOP-8(SOIC-8) | Tape    | 2500Pcs/Reel |



## Schematic



## Pin Configurations



## Pin Description

| Pin |                  | Function               |
|-----|------------------|------------------------|
| No. | Name             |                        |
| 1   | GAIN             | Gain setting pin       |
| 2   | - INPUT          | Inverting input        |
| 3   | +INPUT           | Noninverting input     |
| 4   | GND              | Ground reference       |
| 5   | V <sub>OUT</sub> | Output                 |
| 6   | V <sub>CC</sub>  | Power supply voltage   |
| 7   | BYPASS           | Bypass decoupling path |
| 8   | GAIN             | Gain setting pin       |



## Absolute Maximum Ratings

(Tamb=25℃, Unless otherwise stated)

| Name                      | Symbol | Value    | Unit |
|---------------------------|--------|----------|------|
| Input Voltage             | VIN    | ±0.4     | V    |
| Supply Voltage            | Vcc    | 15       | V    |
| Package Dissipation       | PD     | 660      | mW   |
| Welding temperature (10s) | Ts     | 260      | ℃    |
| Junction temperature      | Tj     | 150      | ℃    |
| Operating temperature     | Tamb   | 0~70     | ℃    |
| Storage temperature       | Tstg   | - 40~125 | ℃    |

## Electrical Characteristics

(Tamb=25℃, Vcc=6V, RL=8Ω, f=1kHz)

| Parameters                   | Symbol | Condition of test                                                         | Min | Typ | Max | Unit |
|------------------------------|--------|---------------------------------------------------------------------------|-----|-----|-----|------|
| Operating Supply Voltage     | Vcc    |                                                                           | 4   |     | 12  | V    |
| Quiescent Current            | Icc    | Vcc=6V, VIN=0                                                             |     | 4   | 8   | mA   |
| Output Power                 | Po     | Vcc=6V, RL=8Ω, THD=10%                                                    | 250 | 325 | -   | mW   |
|                              |        | Vcc=9V, RL=8Ω, THD=10%                                                    | 500 | 700 | -   | mW   |
| Voltage Gain                 | Av     | Vcc=6V, f=1kHz                                                            | -   | 26  | -   | dB   |
|                              |        | 10μF from Pin 1 to 8                                                      |     | 46  |     |      |
| Bandwidth                    | BW     | Vcc=6V, Pins 1 and 8 Open                                                 | -   | 300 | -   | kHz  |
| Total Harmonic Distortion    | THD    | Vcc=6V, RL=8Ω, Po=125mW, f=1kHz<br>Pins 1 and 8 Open                      | -   | 0.2 | -   | %    |
| Power Supply Rejection Ratio | PSRR   | Vcc=6V, f=1kHz, CBYPASS=10uF,<br>Pins 1 and 8 Open, Referred to<br>Output |     | 50  |     | dB   |
| Input Resistance             | RIN    |                                                                           |     | 50  |     | kΩ   |
| Input Bias Current           | IB     | Vcc=6V, Pins 2 and 3 Open                                                 | -   | 250 | -   | nA   |



## Typical Application

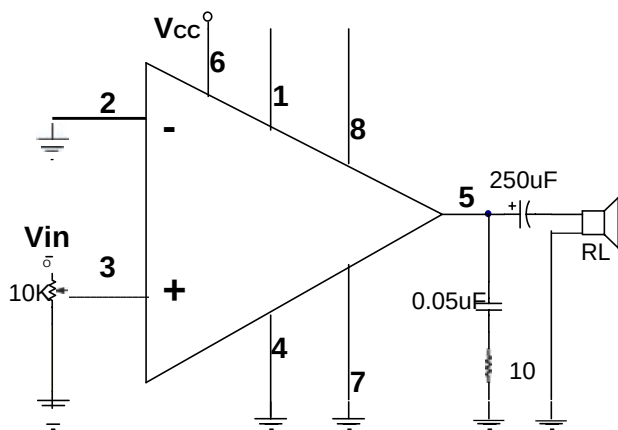


Figure 1. With Gain = 20

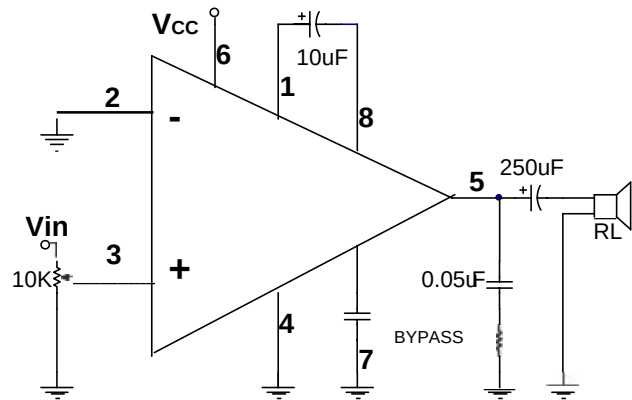


Figure 2. With Gain = 200

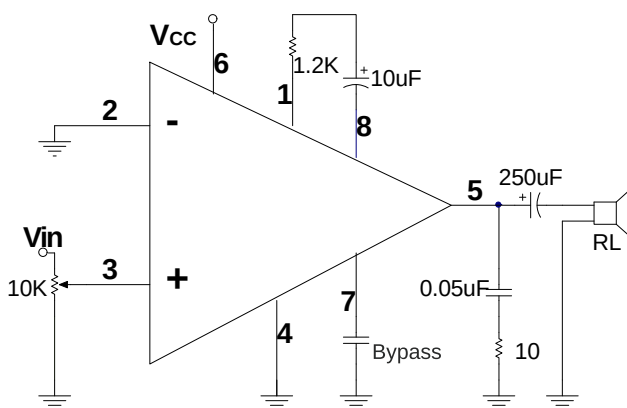


Figure 3 .With Gain = 50

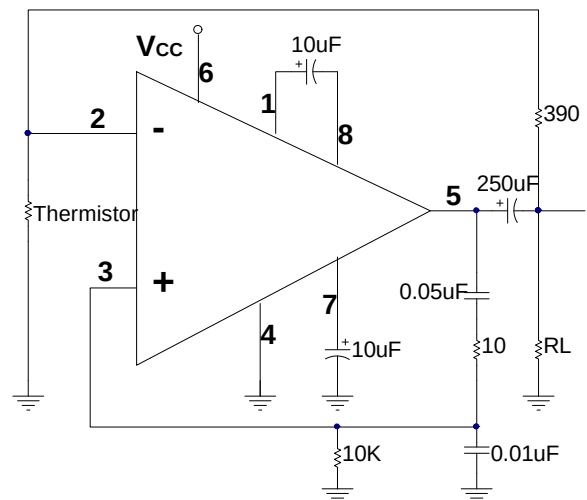


Figure 4 . Low distortion bridge oscillator

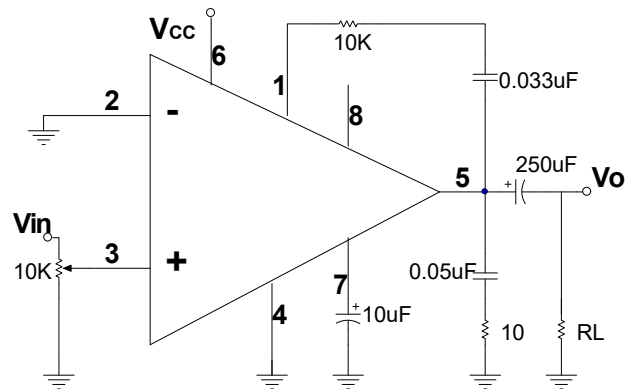


Figure 5 . Low frequency boost amplifier

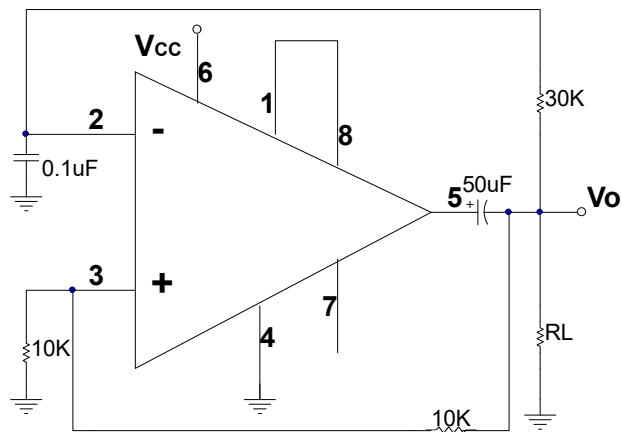


Figure 6 . Square wave oscillator

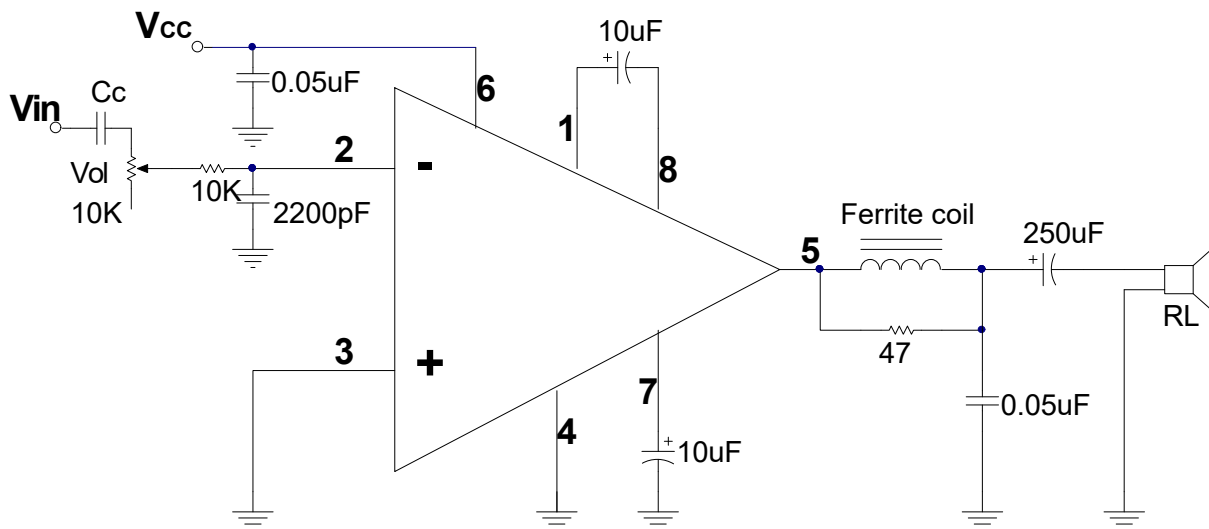


Figure 7 . Amplitude modulation radio audio amplifier



## Application points

### 1、Gain Control

To make the LM386MX-1/NOPB a more versatile amplifier, two pins (1 and 8) are provided for gain control. With pins 1 and 8 open the 1.35-k $\Omega$  resistor sets the gain at 20 (26 dB). If a capacitor is put from pin 1 to 8, bypassing the 1.35-k $\Omega$  resistor, the gain will go up to 200 (46 dB). If a resistor is placed in series with the capacitor, the gain can be set to any value from 20 to 200. Gain control can also be done by capacitively coupling a resistor (or FET) from pin 1 to ground.

Additional external components can be placed in parallel with the internal feedback resistors to tailor the gain and frequency response for individual applications. For example, we can compensate poor speaker bass response by frequency shaping the feedback path. This is done with a series RC from pin 1 to 5 (paralleling the internal 15-k $\Omega$  resistor). For 6 dB effective bass boost:  $R \approx 15$  k $\Omega$ , the lowest value for good stable operation is  $R = 10$  k $\Omega$  if pin 8 is open. If pins 1 and 8 are bypassed then  $R$  as low as 2 k $\Omega$  can be used. This restriction is because the amplifier is only compensated for closed-loop gains greater than 9.

### 2、Input Biasing

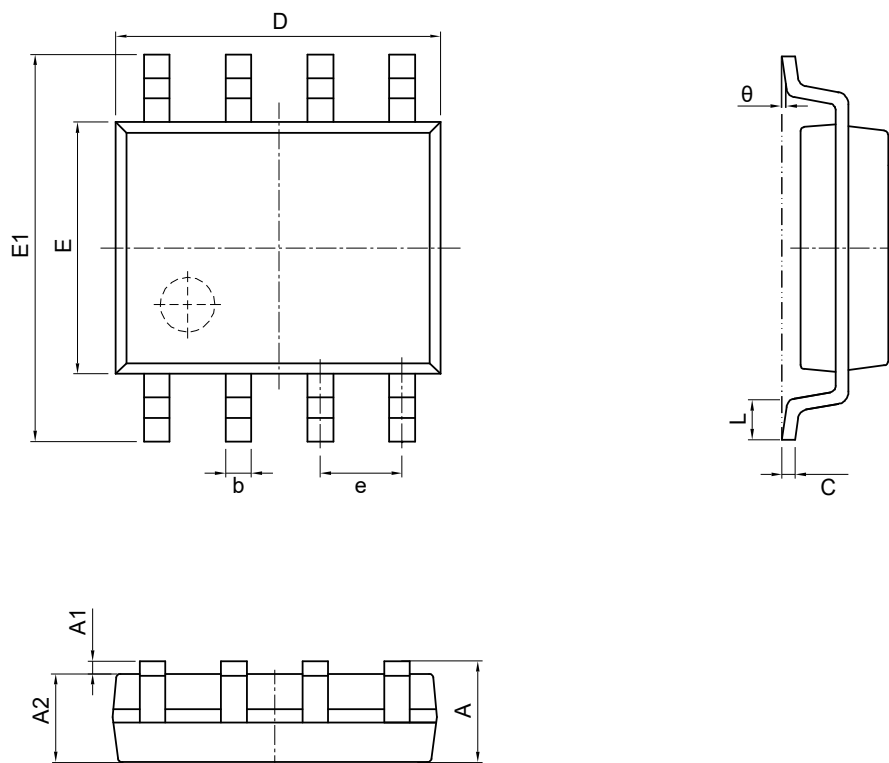
The schematic shows that both inputs are biased to ground with a 50 k $\Omega$  resistor. The base current of the input transistors is about 250 nA, so the inputs are at about 12.5 mV when left open. If the dc source resistance driving the LM386MX-1/NOPB is higher than 250 k $\Omega$  it will contribute very little additional offset (about 2.5 mV at the input, 50 mV at the output). If the dc source resistance is less than 10 k $\Omega$ , then shorting the unused input to ground will keep the offset low (about 2.5 mV at the input, 50 mV at the output). For dc source resistances between these values we can eliminate excess offset by putting a resistor from the unused input to ground, equal in value to the dc source resistance. Of course all offset problems are eliminated if the input is capacitively coupled.

When using the LM386MX-1/NOPB with higher gains (bypassing the 1.35 k $\Omega$  resistor between pins 1 and 8) it is necessary to bypass the unused input, preventing degradation of gain and possible instabilities. This is done with a 0.1  $\mu$ F capacitor or a short to ground depending on the dc source resistance on the driven input.



## Package Information

### SOP-8(SOIC-8)



| Symbol | Size | Dimensions In Millimeters |         | Symbol | Size | Dimensions In Inches |         |
|--------|------|---------------------------|---------|--------|------|----------------------|---------|
|        |      | Min(mm)                   | Max(mm) |        |      | Min(in)              | Max(in) |
| A      |      | 1.350                     | 1.750   | A      |      | 0.053                | 0.069   |
| A1     |      | 0.100                     | 0.250   | A1     |      | 0.004                | 0.010   |
| A2     |      | 1.350                     | 1.550   | A2     |      | 0.053                | 0.061   |
| b      |      | 0.330                     | 0.510   | b      |      | 0.013                | 0.020   |
| c      |      | 0.170                     | 0.250   | c      |      | 0.006                | 0.010   |
| D      |      | 4.700                     | 5.100   | D      |      | 0.185                | 0.200   |
| E      |      | 3.800                     | 4.000   | E      |      | 0.150                | 0.157   |
| E1     |      | 5.800                     | 6.200   | E1     |      | 0.228                | 0.224   |
| e      |      | 1.270(BSC)                |         | e      |      | 0.050(BSC)           |         |
| L      |      | 0.400                     | 1.270   | L      |      | 0.016                | 0.050   |
| θ      |      | 0°                        | 8°      | θ      |      | 0°                   | 8°      |



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