Low voltage audio power amplifier

Description：

The LM386 audio power amplifier is mainly used in low-voltage consumer products. To minimize peripheral components, the voltage gain is built-in at 20. But by adding an external resistor and capacitor between pins 1 and 8, the voltage gain can be adjusted to any value up to 200. The input terminal is referenced to the ground, while the output terminal is automatically biased to half of the power supply voltage. At a 6V power supply voltage, its static power consumption is only 24mW, making the LM386 particularly suitable for battery powered applications. Adopting DIP8/SOP8 packaging

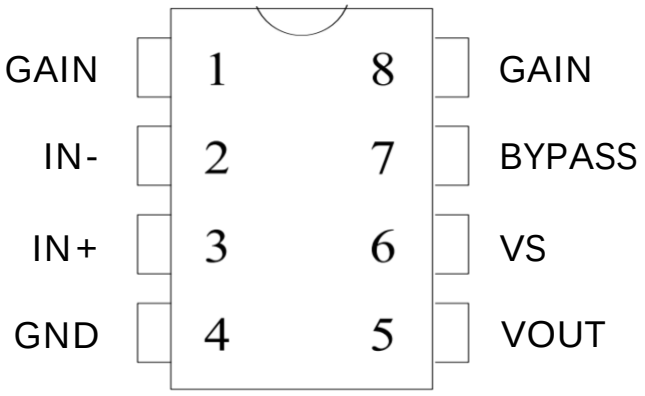
Features：

-Low static power consumption, approximately 4mA, can be powered by batteries
-Wide range of power supply voltage, Vcc=4-12V
-Less peripheral components and low distortion
-Voltage gain adjustable from 20 to 200

Application：

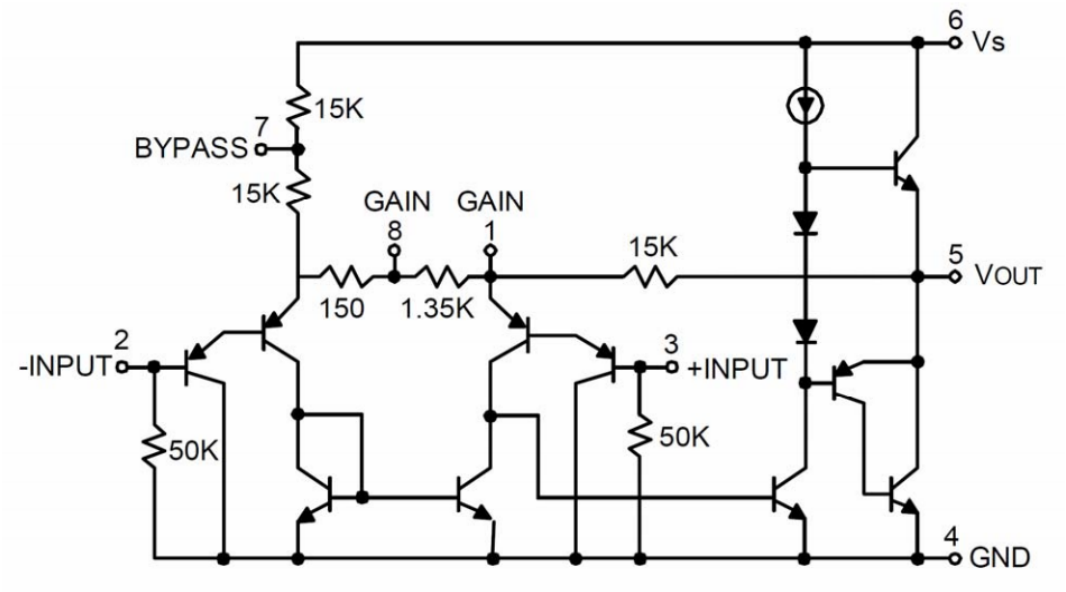
-Portable recorder audio power amplifier
-AM/FM radio audio amplifier
-Television audio system
-Power converter
-Handsfree telephone speaker system
-Small servo driver
-Ultrasonic driver

Pin Assignment：



Pin No.	Symbol	Pin Definition
1	GAIN	gain
2	IN-	negative input
3	IN+	positive input
4	GND	grounding
5	VOUT	output
6	Vs	power supply
7	BYPASS	bypass
8	GAIN	gain

Internal Function Block Diagram：



LM386 Internal Block Diagram

Absolute Maximum Ratings

parameter	symbol	value	unit
Maximum input voltage	VIN	±0.4	V
supply voltage	Vcc	15	V
Maximum allowable power consumption	PD	660	mW
Welding temperature (10 s)	Ts	260	℃
Junction temperature	Tj	150	℃
operation temperature	Tamb	0~70	℃
Storage temperature	Tstg	-40~125	℃

Note: Limit parameters refer to the limit values that cannot be exceeded under any conditions. If this limit value is exceeded, it may cause physical damage such as product deterioration; At the same time, it cannot be guaranteed that the chip can operate normally when approaching the limit parameters.

Electrical characteristics (Vcc=6V,RL=8Ω,f=1kHz,Tamb=25℃)

parameter	symbol	Test conditions	Specification value			unit
			MIN	TYP	MAX	
Working power supply voltage	Vcc		4		12	V
Static power supply 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
Gain	Av	Vcc=6V,f=1kHz	-	26	-	dB
		1 foot, 8 feet indirect 10 μ F capacitor	-	46	-	
bandwidth	BW	Vcc=6V，Pins 1 and 8 open circuit	-	300	-	kHz
total harmonic distortion	THD	Vcc=6V，RL=8Ω，Po=125mW，f=1kHz Pins 1 and 8 open circuit	-	0.2	-	%
power supply rejection rate	PSRR	Vcc=6V，f=1kHz，CBYPASS=10μF，1、8-pin open circuit, output as reference		50		dB
Input Resistance	RIN		-	50	-	kΩ
Input Bias Current	IB	Vcc=6V，2.、3 pin open circuit	-	250	-	nA

Application diagram

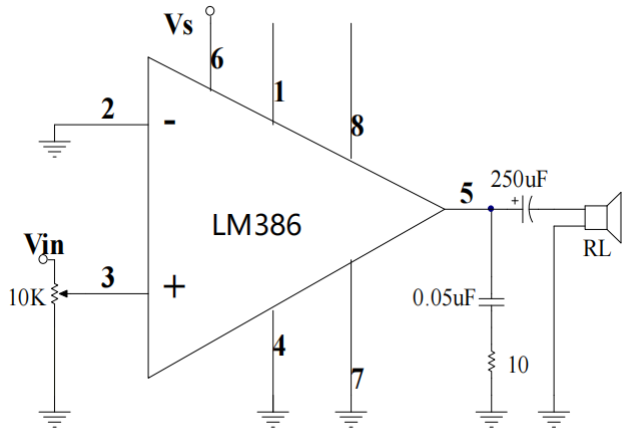


Figure 1 Amplifier Gain=20 (Minimum Devices)

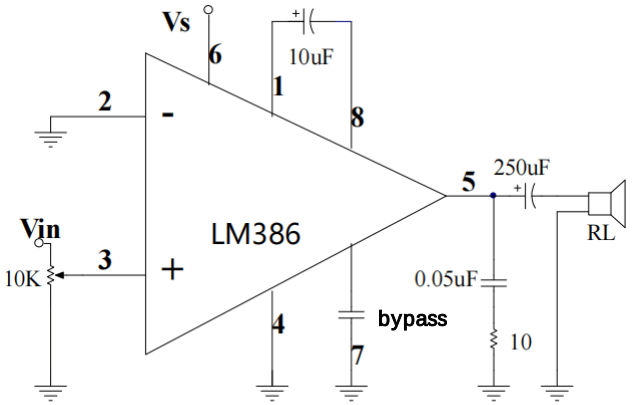


Figure 2 Amplifier Gain=200

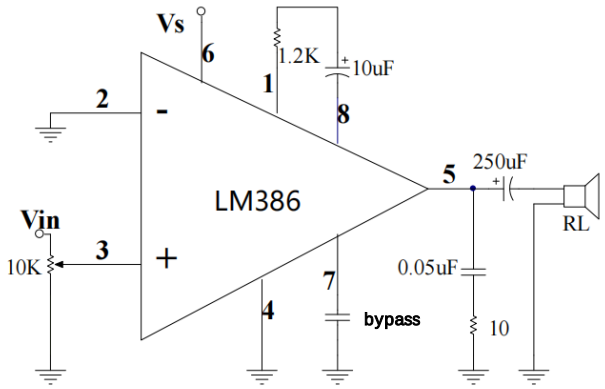


Figure 3 Amplifier gain=50

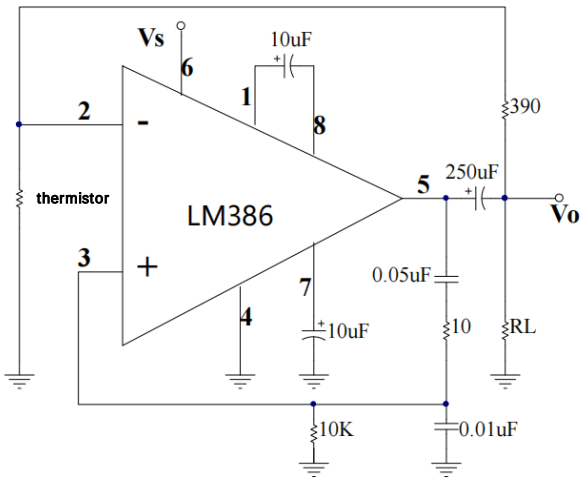


Figure 4 Low distortion bridge oscillator

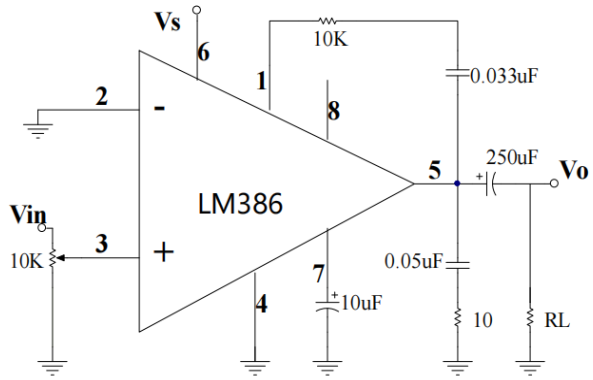


Figure 5 Low frequency boost amplifier

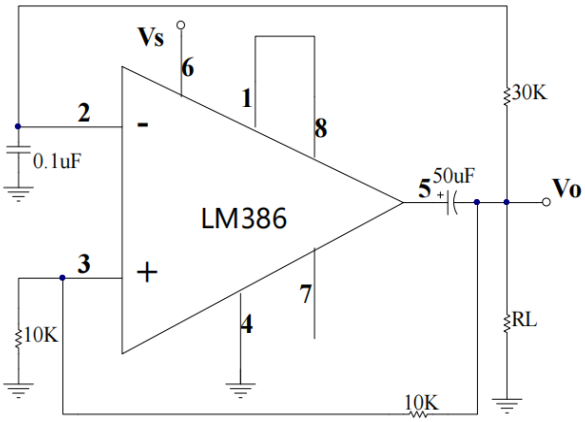


Figure 6 Square wave oscillator

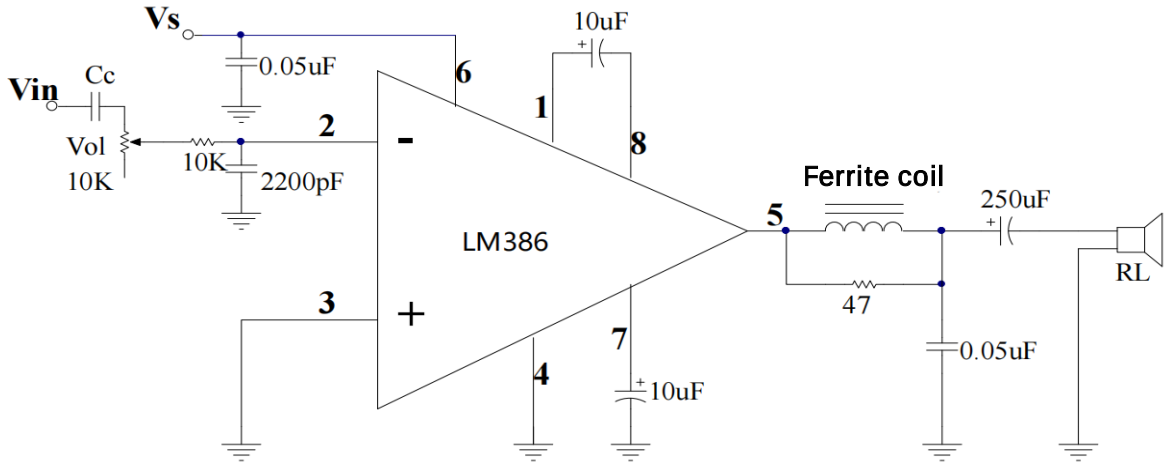


Figure 7. AM Radio Audio Amplifier

Key points of application

1. Gain control

In order to make LM386 more flexible in application, two gain control pins (1 pin and 8 pin) are provided. When pins 1 and 8 are open, a 1.35k Ω resistor sets the gain to 20 (26dB); When a capacitor is connected externally to pin 1 and pin 8 to bypass the 1.35k Ω resistor, the gain increases to 200 (46dB). If an external resistor and capacitor are connected in series, the gain will be adjustable between 20 and 200. Gain control can also be achieved by alternating coupling a resistor (FET) between one pin and ground.

In some special applications, gain and frequency response adjustments can also be made by connecting resistance and capacitance components parallel to the internal negative feedback resistor. For example, I can compensate for the low sensitivity of the speaker in the low frequency range by improving the negative feedback frequency response network, which can be achieved by connecting an RC series network between pins 1 and 5 (parallel to the internal 15k Ω resistor). For an effective low-frequency boost of 6dB: R ≈15k Ω, when the 8-pin circuit is open, the minimum value of R that can ensure stable operation is R=10k Ω. If there is a bypass capacitor between the 1-pin and 8-pin circuit, the minimum value of R decreases to R= 2k Ω. The reason for this limitation is that the amplifier's internal compensation only reaches the closed-loop gain greater than 9.

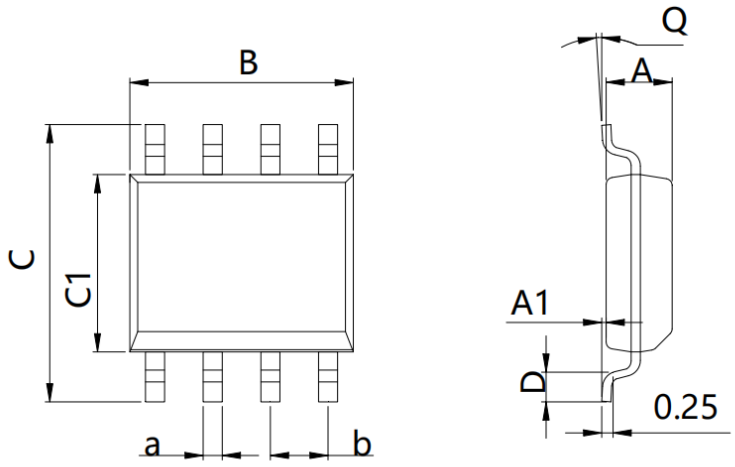
2. Input bias

From the internal equivalent circuit, it can be seen that each of the two input terminals has a 50k Ω resistor connected to the ground. The base current of the input transistor is about 250nA, so the input terminal has a voltage of approximately 12.5mV when in an open circuit When the internal resistance of the LM386 DC signal source is greater than 250k Ω, it will generate a small additional offset (approximately 2.5mV at the input and 50mV at the output). When the internal resistance of the DC signal source is between the two mentioned above, we can eliminate additional offset by connecting a resistor as large as the internal resistance of the signal source between the unused input terminal and the ground. Of course, when using AC coupling at the input end, the issue of additional offset voltage mentioned above no longer exists.

When using LM386 in high voltage gain (1.35k Ω resistor bypass between pins 1 and 8) situations, the unused input terminal must be bypassed to prevent a decrease in gain and possible unstable operation. It can be achieved by connecting a 0.1 μ F capacitor to ground or directly shorting to ground, depending on the internal resistance of the DC signal source.

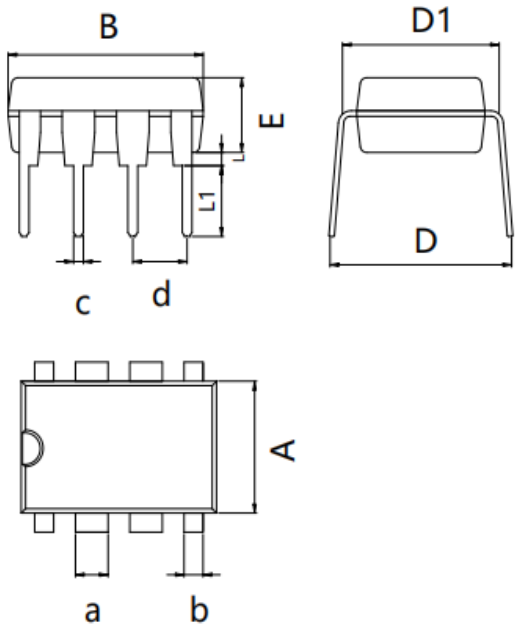
PACKAGE MECHANICAL DATA

SOP8



Dimensions In Millimeters(SOP8)									
Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	1.35	0.05	4.90	5.80	3.80	0.40	0°	0.35	1.27 BSC
Max:	1.55	0.20	5.10	6.20	4.00	0.80	8°	0.45	

DIP8



Dimensions In Millimeters(DIP8)											
Symbol:	A	B	D	D1	E	L	L1	a	b	c	d
Min:	6.10	9.00	8.40	7.42	3.10	0.50	3.00	1.50	0.85	0.40	2.54 BSC
Max:	6.68	9.50	9.00	7.82	3.55	0.70	3.60	1.55	0.90	0.50	