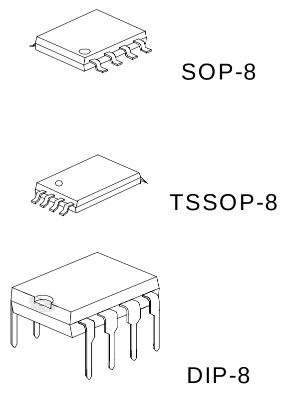
LOW VOLTAGE AUDIO POWER AMPLIFIER



*Pb-free plating product number:LM386L

■ DESCRIPTION

The UTC LM386 is a power amplifier, designed for use in low voltage consumer applications. The gain is internally set to 20 to keep external part count low, but the addition of an external resistor and capacitor between pin 1 and pin 8 will increase the gain to any value up from 20 to 200.

The inputs are ground referenced while the output automatically biases to one-half the supply voltage.The quiescent power drain is only 24 milliwatts when operating from a 6 voltage supply, making the LM386 ideal for battery operation.

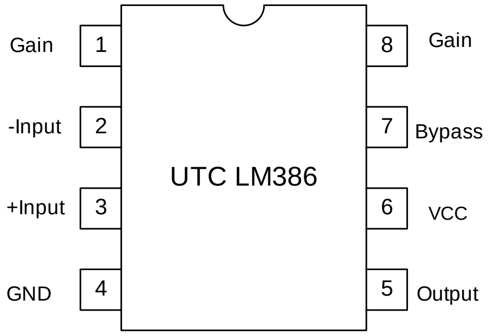
■ FEATURES

*Battery operation
*Minimum external parts
*Wide supply voltage range: 4V~12V
*Low quiescent current drain:4mA
*Voltage gains:20~200
*Ground referenced input
*Self-centering output quiescent voltage
*Low distortion:0.2%(Av =20,Vs=6V,RL=8Ω,Po=125mW,f=1kHz)

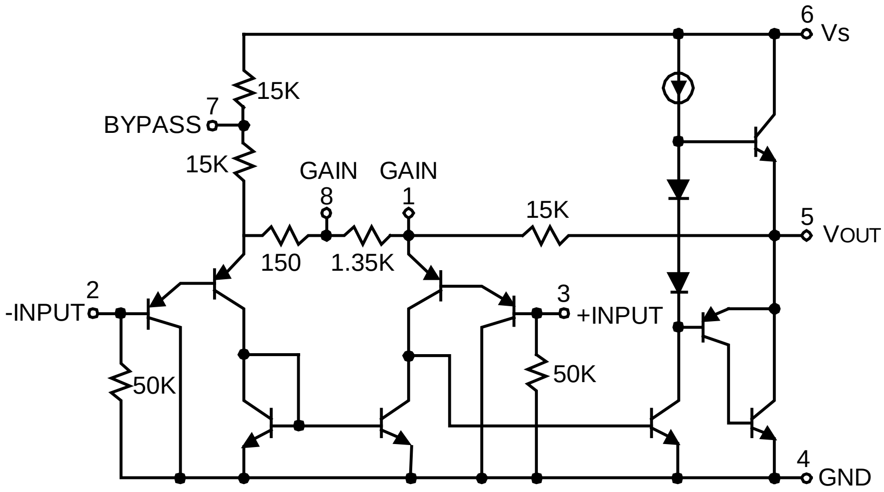
■ ORDERING INFORMATION

Order Number		Package	Packing
Normal	Lead Free Plating		
LM386-S08-R	LM386L-S08-R	SOP-8	Tape Reel
LM386-S08-T	LM386L-S08-T	SOP-8	Tube
LM386-P08-R	LM386L-P08-R	TSSOP-8	Tape Reel
LM386-P08-T	LM386L-P08-T	TSSOP-8	Tube
LM386-D08-T	LM386L-D08-T	DIP-8	Tube

■ PIN CONFIGURATION



■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage		V_{CC}	15	V
Input Voltage		V_{IN}	-0.4V ~ +0.4V	V
Power Dissipation	DIP-8	P_D	1250	mW
	SOP-8		600	
	TSSOP-8		600	
Operating Temperature		T_{OPR}	0 ~ +70	°C
Junction Temperature		T_J	+125	°C
Storage Temperature		T_{STG}	-40 ~ +150	°C

Note:1. Absolute maximum ratings are stress ratings only and functional device operation is not implied. The device could be damaged beyond Absolute maximum ratings.

2. The device is guaranteed to meet performance specifications within 0℃~70℃ operating temperature range and assured by design from –20℃~85℃.

■ ELECTRICAL CHARACTERISTICS (Ta=25°C, unless otherwise specified.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Operating Supply Voltage	Vss		4		12	V
Quiescent Current	I_Q	Vss=6V, V_{IN}=0		4	8	mA
Output Power	P_{OUT}	Vss=6V, R_L=8Ω, THD=10% Vss=9V, R_L=8Ω, THD=10%	250 500	325 700		mW mW
Voltage Gain	G_V	Vss=6V, f=1kHz 10µF from pin 1 to pin 8		26 46		dB dB
Bandwidth	BW	Vss=6V , Pin1 and pin 8 open		300		kHz
Total Harmonic Distortion	THD	P_{OUT}=125mW, Vs=6V,f=1kHz R_L=8Ω pin1 and pin 8 open		0.2		%
Rejection Ratio	RR	Vss=6V, f=1kHz, C_{BYPASS}=10µF pin1and pin 8 open, Referred to output		50		dB
Input Resistance	R_{IN}			50		kΩ
Input Bias Current	I_{BIAS}	Vss=6V Pin2 and pin 3 open		250		nA

APPLICATION NOTES

GAIN CONTROL

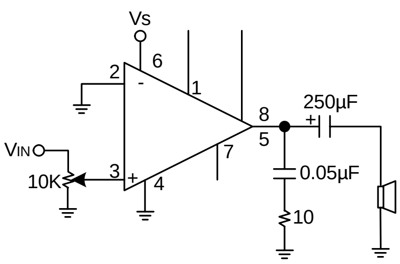
To make the LM386 a more versatile amplifier, two pins(1and 8) are provided for gain control. With pins 1 and 8 open the 1.35 kΩ resistor sets the gain at 20(26dB),If a capacitor is put from pin 1 to 8,bypassing the 1.35 kΩ resistor, the gain will go up to 200(46dB).If a resistor is placed in series 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 kΩ resistor). For 6 dB effective bass boost: R=15 kΩ, the lowest value for good stable operation is R=10 kΩ, if pin 8 is open, If pins 1 and 8 are bypassed then R as low as 2 kΩ can be used. This restriction is because the amplifier is only compensated for closed-loop gains greater than 9.

INPUT BIASING

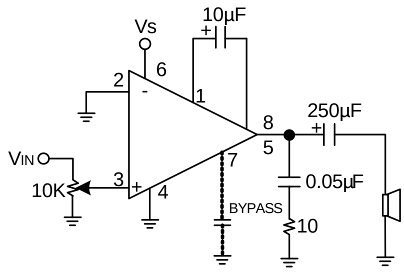
The schematic shows that both inputs are biased to ground with a 50 kΩ resistor. The base current of the input transistors is about 250nA, so the inputs are at about 12.5mW when left open. If the dc source resistance driving the LM386 is higher than 250 kΩ it will contribute very little additional offset (about 2.5mW at the input, 50mW at the output).If the dc source resistance is less than 10 kΩ,then shorting the unused input to ground will keep the offset low (about 2.5mV 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 LM386 with higher gains (bypassing the 1.35 kΩ 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 0.1μF capacitor or a short to ground depending on the dc source resistance on the driven input.

TYPICAL APPLICATIONS CIRCUIT

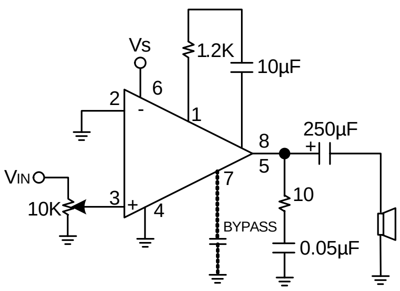
Amplifier with Gain=20
Minimum Parts



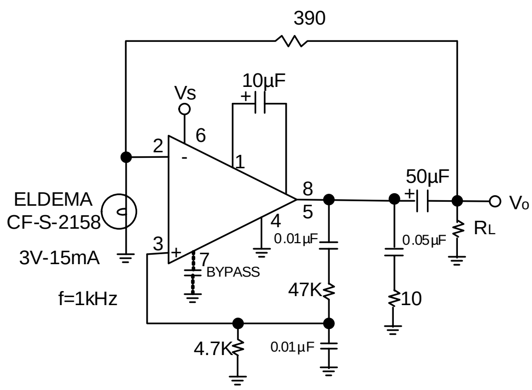
Amplifier with Gain=200



Amplifier with Gain=50

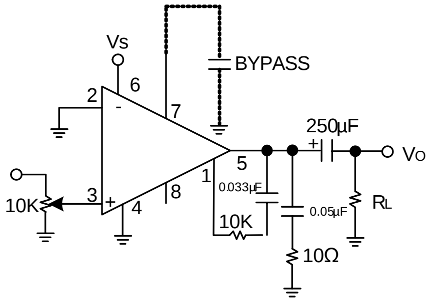


Low Distortion Power Wienbridge Oscillator

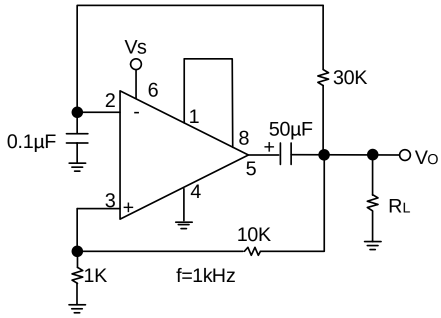


■ TYPICAL APPLICATIONS CIRCUIT(cont.)

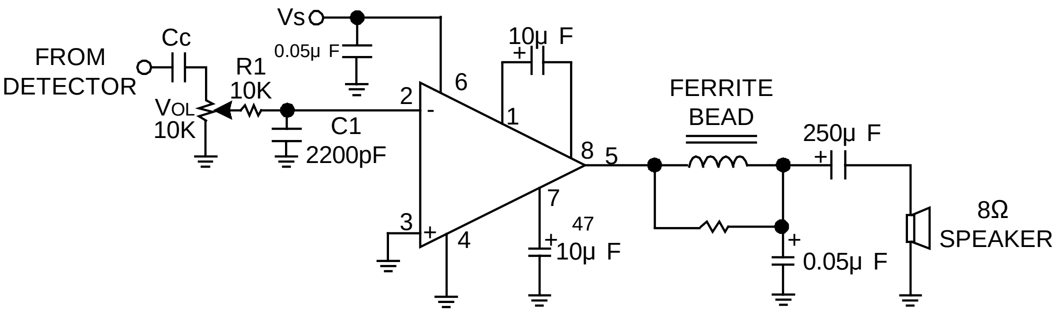
Amplifier with Bass Boost



Square Ware Oscillator



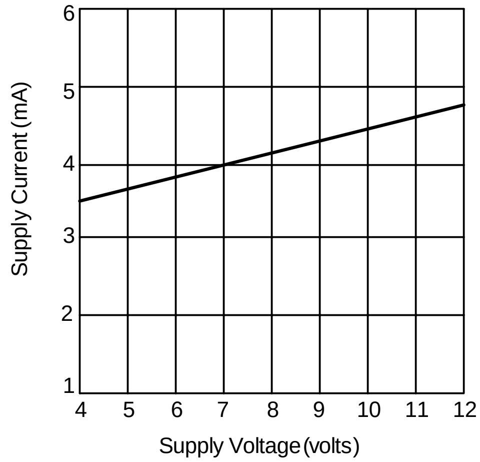
AM Radio Power Amplifier



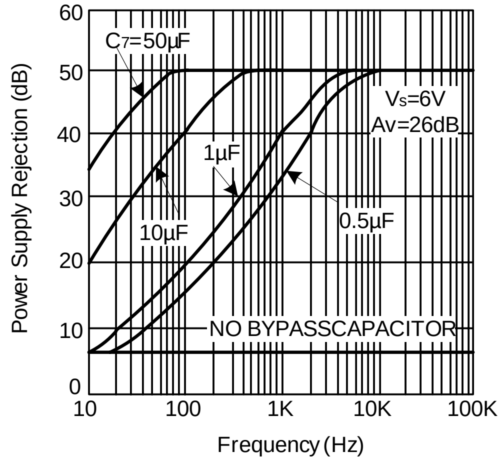
Note 1: Twist Supply lead and supply ground very tightly.
Note 2: Twist speaker lead and ground very tightly.
Note 3: Ferrite bead in Ferroxcube K5-001-001/3B with 3 turns of wire.
Note 4: R1C1 band limits input signals.
Note 5: All components must be spaced very closely to IC.

■ TYPICAL CHARACTERISTICS

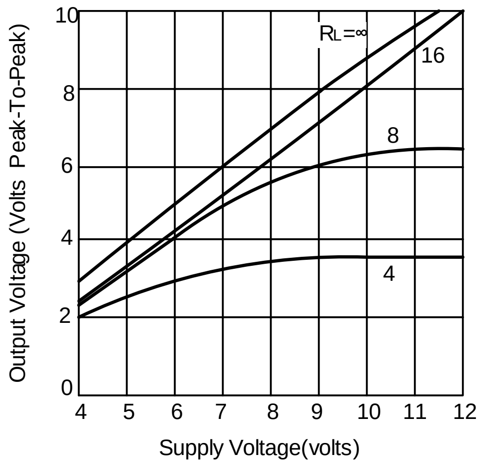
Quiescent Supply Current vs Supply Voltage



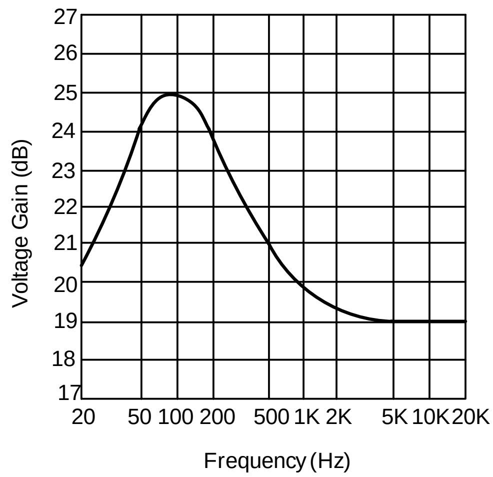
Power Supply Rejection Ratio(Referred to the Output) vs Frequency



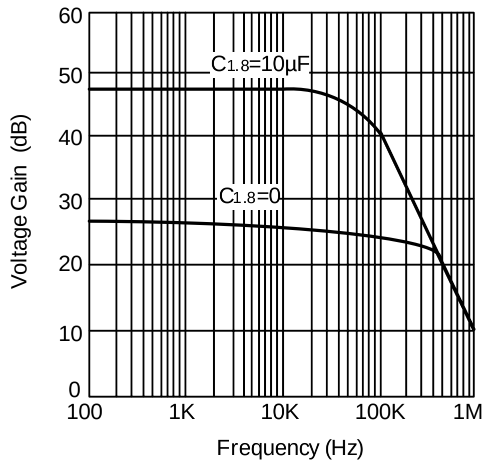
Peak-to -Peak Output Voltage Swing vs Supply Voltage



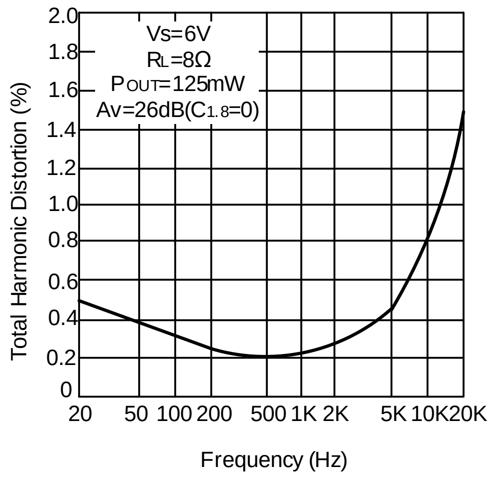
Frequency Response With Bass Boost



Voltage Gain vs Frequency



Distortion vs Frequency



■ TYPICAL CHARACTERISTICS(cont.)