

POWER AUDIO AMPLIFIER IC LM380:

Features of LM380:

1. Internally fixed gain of 50 (34dB)
2. Output is automatically self centring to one half of the supply voltage.
3. Output is short circuit proof with internal thermal limiting.
4. Input stage allows the input to be ground referenced or ac coupled.
5. Wide supply voltage range (5 to 22V).
6. High peak current capability.
7. High impedance.
8. Low total harmonic distortion
9. Bandwidth of 100KHz at $P_{out} = 2W$ & $R_L = 8\Omega$

Introduction:

Small signal amplifier are essentially voltage amplifier that supply their loads with larger amplifier signal voltage.

On the other hand , large signal or power amplifier supply a large signal current to current operated loads such as speakers & motors.

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In audio applications, however, the amplifier called upon to deliver much higher current than that supplied by general purpose op-amps. This means that loads such as speakers & motors requiring substantial currents cannot be driven directly by the output of general purpose opo-amps.

However there are two possible solutions,

- To use discrete or monolithic power transistors called power boosters at the output of the op-amp
- To use specialized ICs designed as power amplifiers.

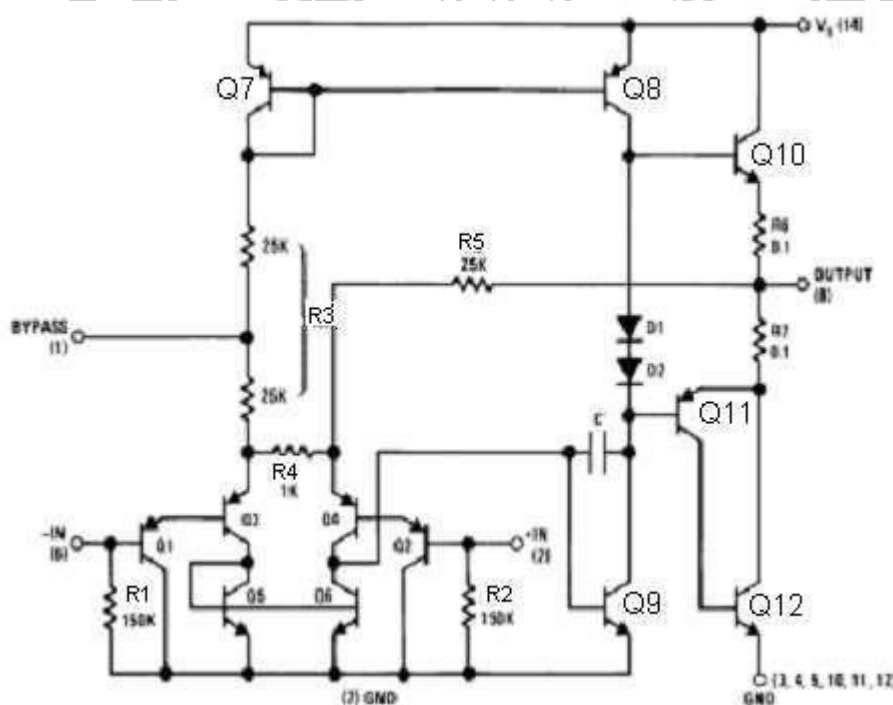


Fig : Functional block diagram of Audio Power Amplifier

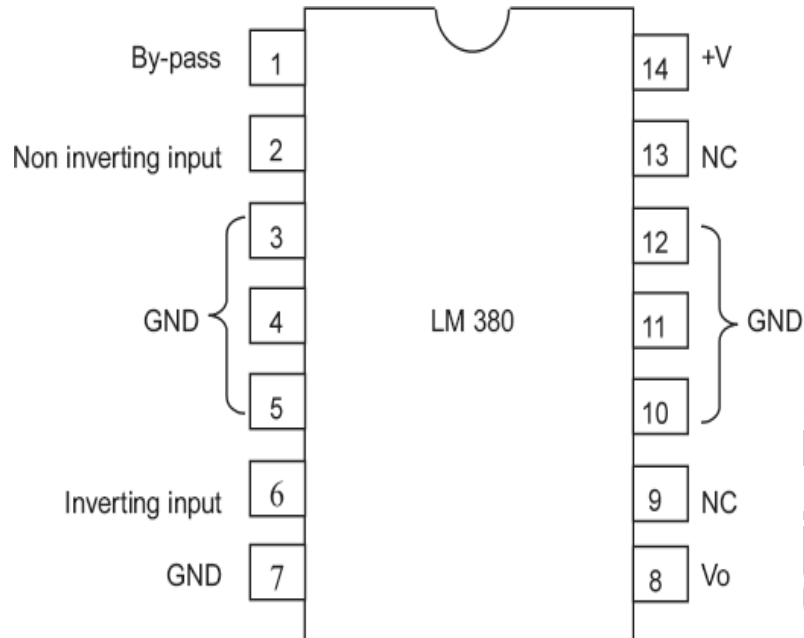


Fig: Pin diagram

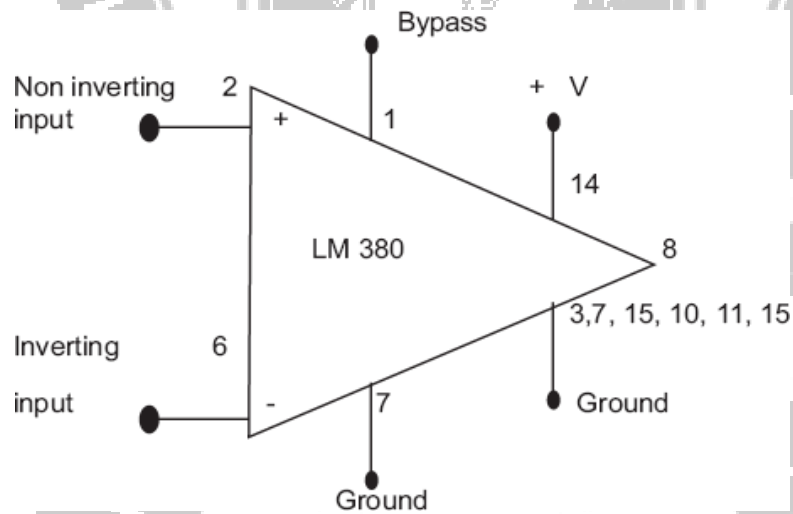


Fig : Block diagram

LM380 circuit description:

It is connected of 4 stages,

- (i) PNP emitter follower
- (ii) Different amplifier
- (iii) Common emitter
- (iv) Emitter follower

(i) PNP Emitter follower:

- The input stage is emitter follower composed of PNP transistors Q1 & Q2 which drives the PNP Q3-Q4 differential pair.
- The choice of PNP input transistors Q1 & Q2 allows the input to be referenced to ground i.e., the input can be direct coupled to either the inverting & non-inverting terminals of the amplifier.

(ii) Differential Amplifier:

- The current in the PNP differential pair Q3-Q4 is established by Q7, R3 & +V.
- The current mirror formed by transistor Q7, Q8 & associated resistors then establishes the collector current of Q9.
- Transistor Q5 & Q6 constitute of collector loads for the PNP differential pair.
- The output of the differential amplifier is taken at the junction of Q4 & Q6 transistors & is applied as an input to the common emitter voltage gain.

(iii) Common Emitter:

- Common Emitter amplifier stage is formed by transistor Q9 with D1, D2 & Q8 as a current source load.

- The capacitor C between the base & collector of Q_9 provides internal compensation & helps to establish the upper cutoff frequency of 100 KHz.
- Since Q_7 & Q_8 form a current mirror, the current through D_1 & D_2 is approximately the same as the current through R_3 .
- D_1 & D_2 are temperature compensating diodes for transistors Q_{10} & Q_{11} in that D_1 & D_2 have the same characteristics as the base-emitter junctions of Q_{11} . Therefore the current through Q_{10} & (Q_{11} - Q_{12}) is approximately equal to the current through diodes D_1 & D_2 .

(iv) (Output stage) - Emitter follower:

- Emitter follower formed by NPN transistor Q_{10} & Q_{11} . The combination of PNP transistor Q_{11} & NPN transistor Q_{12} has the power capability of an NPN transistors but the characteristics of a PNP transistor.
- The negative dc feedback applied through R_5 balances the differential amplifier so that the dc output voltage is stabilized at $+V/2$;
- To decouple the input stage from the supply voltage $+V$, by pass capacitor in order of micro farad should be connected between the by pass terminal (pin 1) & ground (pin 7).

The overall internal gain of the amplifier is fixed at 50. However gain can be increased by using positive feedback.

