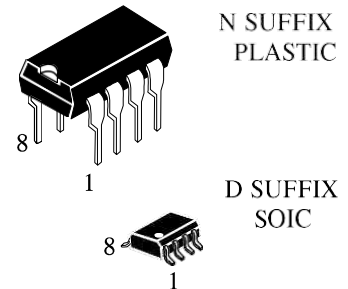


## LOW VOLTAGE AUDIO POWERAMPLIFIER

The HT386A 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 pins 1 and 8 will increase the gain to any value up to 200.

The inputs are ground referenced while the output is automatically biased to one half the supply voltage. The quiescent power drain is only 24 milliwatts when operating from a 6 volt supply, making the HT386A ideal for battery operation.

- 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
- Eight Pin Dual-In-Line Package



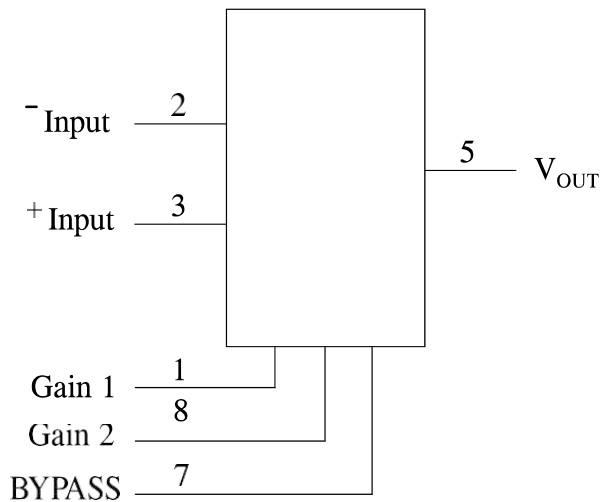
### ORDERING INFORMATION

HT386AN Plastic

HT386AR SOIC

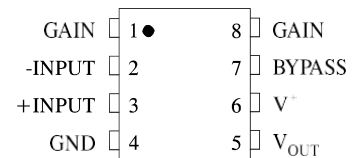
$T_A = 0^\circ$  to  $70^\circ$  C for package

### LOGIC DIAGRAM



Pin 4 = GND  
 Pin 6 = Supply Voltage  $V^+$

### PIN ASSIGNMENT





**MAXIMUM RATINGS**

| Symbol           | Parameter            | Value       | Unit |
|------------------|----------------------|-------------|------|
| V <sub>CC</sub>  | Supply Voltage       | 15          | V    |
| V <sub>IN</sub>  | Input Voltage        | ±0.4        | V    |
| P <sub>D</sub>   | Power Dissipation    | 1.25        | W    |
| T <sub>stg</sub> | Storage Temperature  | -65 to +150 | °C   |
| T <sub>J</sub>   | Junction Temperature | +150        | °C   |
| T <sub>L</sub>   | Lead Temperature     | +300        | °C   |

Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

**RECOMMENDED OPERATING CONDITIONS**

| Symbol          | Parameter                                | Min | Max | Unit |
|-----------------|--|-----|-----|------|
| V <sub>CC</sub> | Supply Voltage                           | 4.0 | 12  | V    |
| T <sub>A</sub>  | Operating Temperature, All Package Types | 0   | +70 | °C   |

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V<sub>IN</sub> and V<sub>OUT</sub> should be constrained to the range GND ≤ (V<sub>IN</sub> or V<sub>OUT</sub>) ≤ V<sub>CC</sub>.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V<sub>CC</sub>). Unused outputs must be left open.

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

| Symbol          | Parameter                    | Test Conditions  | Guaranteed Limits |             |     | Unit |
|-----------------|------------------------------|--|-------------------|-------------|-----|------|
|                 |                              |  | Min               | Typ         | Max |      |
| V <sup>+</sup>  | Operating Supply Voltage     |  | 4                 |             | 12  | V    |
| I <sup>+</sup>  | Quiescent Current            | V <sup>+</sup> = 6 V, V <sub>IN</sub> = 0  |                   |             | 8   | mA   |
| P <sub>O</sub>  | Output Power                 | V <sup>+</sup> = 6V, R <sub>L</sub> = 8Ω, THD = 10%<br>V <sup>+</sup> = 9V, R <sub>L</sub> = 8Ω, THD = 10% |                   | 325<br>1000 |     | mW   |
| A <sub>v</sub>  | Voltage Gain                 | V <sup>+</sup> = 6V, f = 1kHz<br>10μF from Pin 1 and 8   |                   | 26<br>46    |     | dB   |
| BW              | Bandwidth                    | V <sup>+</sup> = 6V, Pins 1 and 8 Open   | 250               |             |     | KHz  |
| THD             | Total Harmonic Distortion    | V <sup>+</sup> = 6V, R <sub>L</sub> = 8Ω, P <sub>OUT</sub> = 125mW,<br>f = 1kHz,<br>Pins 1 and 8 Open      |                   |             | 1.0 | %    |
| PSRR            | Power Supply Rejection Ratio | V <sup>+</sup> = 6V, f = 1kHz, C <sub>BYPASS</sub> = 10μF,<br>Pins 1 and 8 Open                            |                   | 45          |     | dB   |
| R <sub>IN</sub> | Input Resistance             |  | 30                |             | 80  | KΩ   |
| I <sub>B</sub>  | Input Bias Current           | V <sup>+</sup> = 6V, Pins 2 and 3 Open   |                   | 250         |     | nA   |

## APPLICATION INFORMATION

### GAIN CONTROL

To make the HT386A 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.

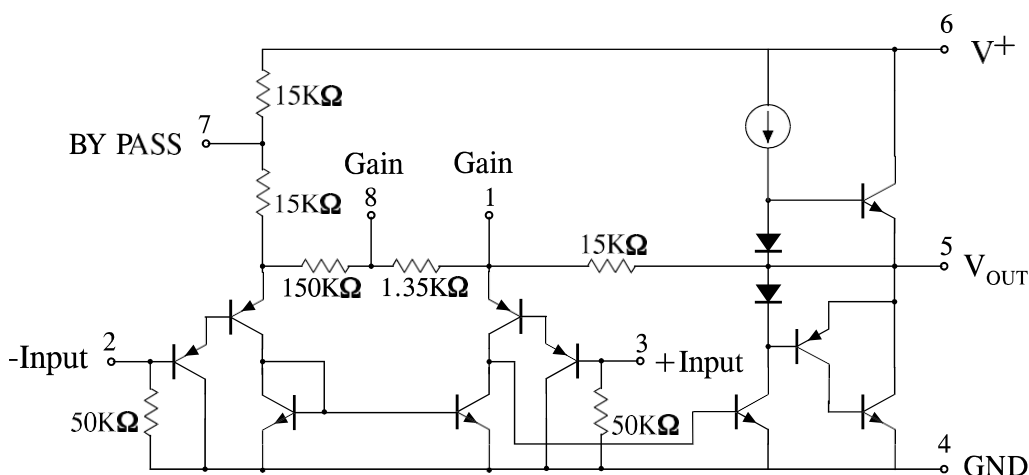
Additional external components can be placed in parallel with the internal feedback resistors to tailor the gain and frequency response for individual applications. For example, we can compensate poor speaker bass response by frequency shaping the feedback path. This is done with a series RC from pin 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.

### 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 out 12.5 mV when left open. If the dc source resistance driving the HT386A 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 HT386A with higher gains (by passing 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.

### SCHEMATIC DIAGRAM



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