

PRODUCT OVERVIEW

The AM-500 series amplifiers are ultra-fast settling operational amplifiers for use in inverting applications. A unique feedforward amplifier design combines the characteristics of a low drift dc amplifier with those of a very fast AC amplifier. For optimum fast settling performance, this amplifier has an open loop gain roll-off of 6 dB per octave to beyond 100 MHz. Miniature thin-film hybrid construction permits an optimum combination of semiconductor devices and minimum lead lengths to realize the amplifier circuitry. Applications for the AM-500 Series include fast integrators, sample-holds, fast waveform drivers, and fast D/A converter output amplifiers.

Output settling time is 200 nanoseconds maximum to 0.01% for a 10 dc volt step change. Slew rate is 1000V/microsecond for positive output transitions and 1800V/microsecond for negative transitions. This high slew rate permits undistorted reproduction of a full load, 20V peak-to-peak sinewave out to 16 MHz. Gain bandwidth product is 100 MHz minimum.

AM-500 series dc characteristics include a dc open loop gain of 10^6 , 30 megohm input impedance, and 1 nanoampere bias current. Input offset voltage is ± 0.5 mV and input offset voltage drift is 1 microvolt/ $^{\circ}$ C. Although these amplifiers do not operate differentially, a dc offset voltage in

the range of ± 5 V dc can be applied to the positive input terminal.

Power supply requirement is ± 15 V dc at 22 mA quiescent current. The amplifiers will operate over a supply range of ± 10 V to ± 18 V dc. Output current capability is ± 50 mA with output short circuit protection. Three basic versions are available: AM-500GC and AM-500MC for 0° C to $+10^{\circ}$ C, and the AM-500MM for -55° C to $+125^{\circ}$ C. The device package is a 14-pin ceramic DIP.

FEATURES

- 200 Nanoseconds settling to 0.01%
- 100V/Microsecond slew rate
- 100 MHz Minimum gain-bandwidth
- 10^6 Open loop gain
- 1 Microvolt/ $^{\circ}$ C drift
- ± 50 mA Output current

| PIN | FUNCTION |
|-----|----------|
| 1 | N.C. |
| 2 | N.C. |
| 3 | N.C. |
| 4 | -INPUT |
| 5 | +INPUT |
| 6 | -SUPPLY |
| 7 | N.C. |
| 8 | COMMON |
| 9 | N.C. |
| 10 | OUTPUT |
| 11 | + SUPPLY |
| 12 | N.C. |
| 13 | N.C. |
| 14 | N.C. |

FUNCTIONAL BLOCK DIAGRAM

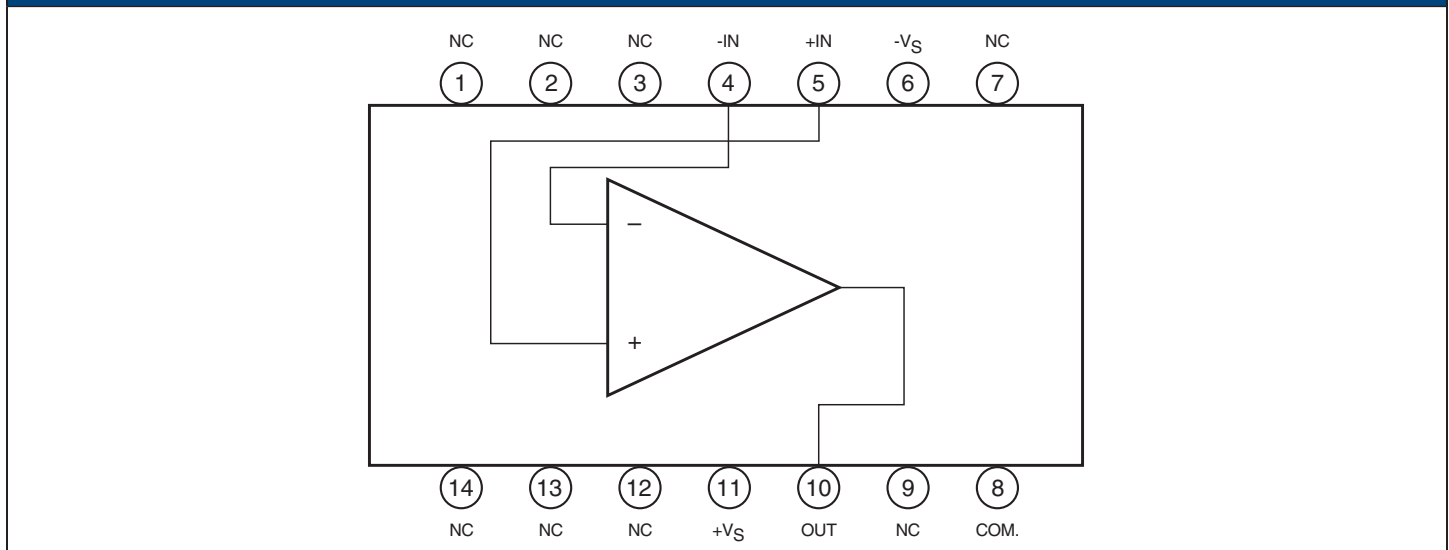


Figure 1. Functional Block Diagram

FUNCTIONAL SPECIFICATIONS

(Typical at +25°C, ±15V dc supply, unless otherwise noted.)

| INPUT CHARACTERISTICS | MIN. | TYP. | MAX. | UNITS |
|--------------------------------------------|--------------------|-----------------|------|-------|
| Common Mode Voltage Range ① | — | ±5 | — | Volts |
| Maximum Input Voltage, no damage | — | ±18 | — | Volts |
| Differential Input Impedance | 3 | 30 | — | Meg |
| Input Bias Current | — | 1 | 4 | nA |
| Input Offset Current | — | 0.5 | 8 | nA |
| Input Offset Voltage | — | 0.5 | 3 | mV |
| OUTPUT CHARACTERISTICS | | | | |
| Output Voltage | ±10 | — | — | Volts |
| Output Current, S.C. protected | ±25 | ±50 | — | mA |
| Stable Capacitive Load | — | 100 | — | pF |
| Output Impedance | — | 25 | — | Ω |
| PERFORMANCE | | | | |
| DC Open Loop Gain | — | 10 ⁶ | — | V/V |
| Input Offset Voltage Drift | | | | |
| 0°C to +70°C | — | 1 | 5 | μV/°C |
| -55°C to +125°C | — | 5 | 10 | μV/°C |
| Input Bias Current Drift | | | | |
| 0°C to +70°C | — | -20 | — | pA/°C |
| -55°C to +125°C | doubles every 10°C | | | |
| Input Voltage Noise ② | | | | |
| 0.01 Hz to 1 Hz | — | 15 | — | μVp-p |
| 100 Hz to 10 kHz | — | 1.6 | — | μVrms |
| 1 Hz to 10 MHz | — | 5.2 | — | μVrms |
| Input Current Noise ④ | | | | |
| 0.01Hz to 10Hz | — | 5 | 25 | μVp-p |
| 100Hz to 10kHz | — | 1 | 5 | μVrms |
| 10Hz to 1MHz | — | 20 | 100 | μVrms |
| Power Supply Rejection Ratio | 80 | — | — | dB |
| DYNAMIC CHARACTERISTICS | | | | |
| Gain Bandwidth Product | 100 | 130 | — | MHz |
| Slew Rate, positive going | — | 1000 | — | V/μs |
| Slew Rate, negative going | — | 1800 | — | V/μs |
| Full Power Frequency (20V peak-to-peak) | — | 16 | — | MHz |
| Settling Time | | | | |
| 10V step to 1% ³ | — | 70 | — | ns |
| 10V step to 0.1% ³ | — | 100 | — | ns |
| 10V step to 0.01% ³ | — | — | 200 | ns |
| Overload Recovery Time | — | 10 | — | μs |
| POWER REQUIREMENTS | | | | |
| Voltage, rated performance | — | ±15 | — | Vdc |
| Voltage, operating | ± 10 | — | ± 18 | Vdc |
| Quiescent Current | — | 22 | 33 | mA |

Footnotes:

- ① dc only
- ② - 3 dB Single-pole bandwidth
- ③ 1k Input and feedback resistors, 2.4 pF feedback capacitor

| PHYSICAL/ENVIRONMENTAL | MIN. | TYP. | MAX. | UNITS |
|------------------------|-------------------------|------|------|-------|
| Operating Temp. Range | | | | |
| AM-500GC | 0 | — | +70 | °C |
| AM-500MC | 0 | — | +70 | °C |
| AM-500MM, MM-QL | -55 | — | +125 | °C |
| Storage Temp. Range | -55 | — | +125 | °C |
| Package Type | 14-pin ceramic | | | |
| Pins | 0.010x0.018" Kovar | | | |
| Weight | 0.09 ounces (2.5 grams) | | | |

TECHNICAL NOTES

- The circuit design shows the connection of the AM-500 series for fast settling operation with a closed loop gain of -1. It can be used for fast settling at closed loop gains up to -10. The equivalent resistance seen by the summing junction should be 500 ohms or less. For gains larger than -1 use an input resistor of 500 ohms and pick a feedback resistor for the required closed loop gain (1k for -2, 1.5k for -3, etc.).
- A small feedback capacitor should be used across the feedback resistor. Determine C in nanofarads from the following formula:

$$C = \frac{1 + |G|}{0.816R_f}$$

where G is closed loop gain and R_f is in kilohms.

- Summing point leads must be kept as short as possible. Input and feedback resistors should be soldered close to the body of the resistor directly to the summing point (pin 4). Summing point capacitance to ground must be kept very low.
- Low output impedance power supplies should be used with 1 μF tantalum bypassing capacitors at the amplifier supply terminals. There are internal 0.03 μF ceramic capacitors in the amplifier.
- Although these amplifiers are inverting mode only, a dc voltage in the range of ± 5V may be applied to the positive input terminal for offsetting the amplifier.
- For interrupted power applications, apply power to the AM-500 three (3) seconds before operating the device.

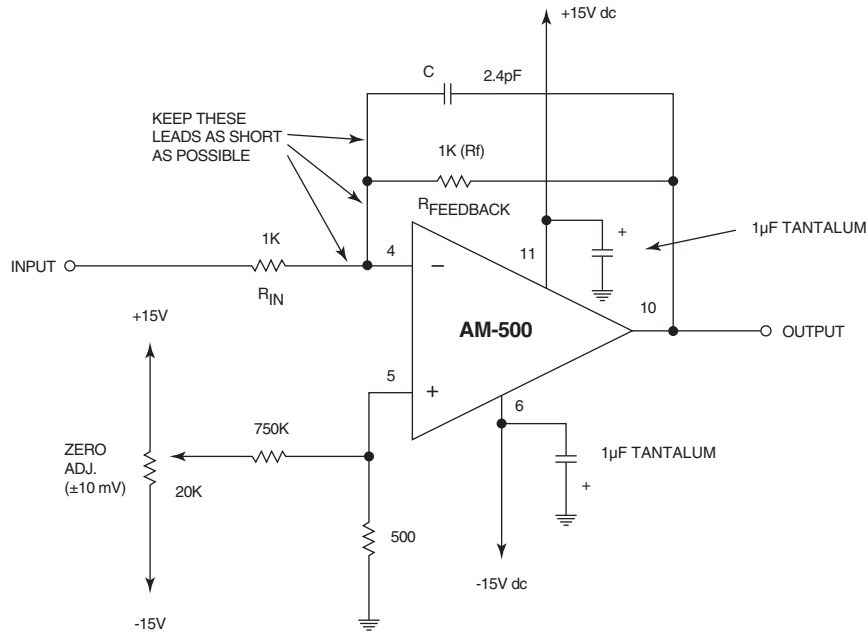


Figure 2. Connection for Fast Settling with Gain of -1

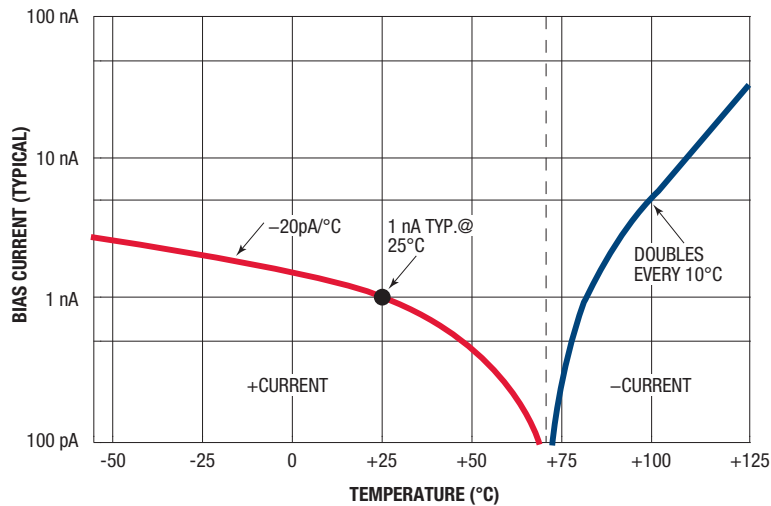
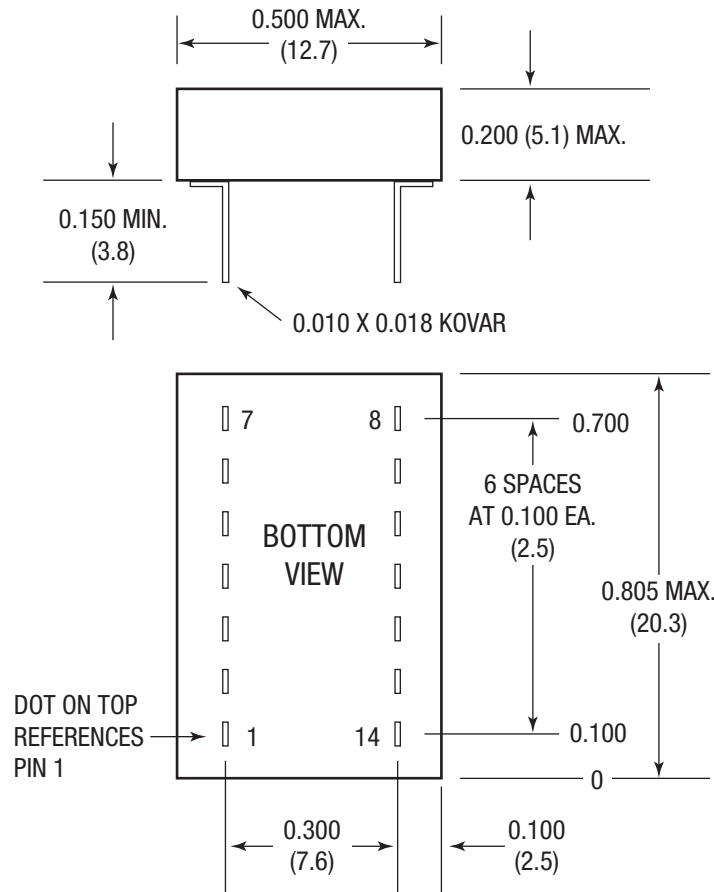


Figure 3. Input Bias Current vs. Temperature

MECHANICAL DIMENSIONS - INCHES (mm)



NOTE: PINS HAVE 0.025 INCH STANDOFF FROM CASE

| ORDERING INFORMATION | | |
|----------------------|-----------------------|-------|
| MODEL NUMBER | OPERATING TEMP. RANGE | SEAL |
| AM-500GC | 0 to +70°C | Epoxy |
| AM-500MC | 0 to +70°C | Herm. |
| AM-500MM | -55 to +125°C | Herm. |

For devices compliant to MIL-STD-883, consult the factory.

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